SELECTED WATER RESOURCES ABSTRACTS

VOLUME 4, NUMBER 5
MARCH 1, 1971

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WATER RESOURCES ABSTRACTS

A Semimonthly Publication of the Water Resources Scientific Information Center,
Office of Water Resources Research, U.S. Department of the Interior

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As the Nation's principal conservation agency, the Department of the Interior has basic responsibilities for water, fish, wildlife, mineral, land, park, and recreational resources. Indian and Territorial affairs are other major concerns of America's "Department of Natural Resources."

The Department works to assure the wisest choice in managing all our resources so each will make its full contribution to a better United States—now and in the future.

FOREWORD

Selected Water Resources Abstracts, a semimonthly journal, includes abstracts of current and earlier pertinent monographs, journal articles, reports, and other publication formats. The contents of these documents cover the water-related aspects of the life, physical, and social sciences as well as related engineering and legal aspects of the characteristics, conservation, control, use, or management of water. Each abstract includes a full bibliographical citation and a set of descriptors or identifiers which are listed in the **Water Resources Thesaurus** (November 1966 edition). Each abstract entry is classified into ten fields and sixty groups similar to the water resources research categories established by the Committee on Water Resources Research of the Federal Council for Science and Technology.

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To provide WRSIC with input, selected organizations with active water resources research programs are supported as "centers of competence" responsible for selecting, abstracting, and indexing from the current and earlier pertinent literature in specified subject areas.

Additional "centers of competence" have been established in cooperation with the Environmental Protection Agency. A directory of the Centers appears on inside back cover.

The input from these Centers, and from the 51 Water Resources Research Institutes administered under the Water Resources Research Act of 1964, as well as input from the grantees and contractors of the Office of Water Resources Research and other Federal water resources agencies with which the Center has agreements becomes the information base from which this journal is, and other information services will be, derived; these services include bibliographies, specialized indexes, literature searches, and state-of-the-art reviews.

Comments and suggestions concerning the contents and arrangements of this bulletin are welcome.

Water Resources Scientific Information Center
Office of Water Resources Research
U.S. Department of the Interior
Washington, D. C. 20240

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SELECTED WATER RESOURCES ABSTRACTS

01. NATURE OF WATER

1B. Aqueous Solutions and Suspensions

ELECTROLYTIC CONDUCTANCE AND THE CONDUCTANCES OF THE HALOGEN ACIDS IN WATER,
National Bureau of Standards, Washington, D.C. Inst. for Basic Standards.
Walter J. Hamer, and Harold J. DeWane.
For sale by the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402 Price $0.50. National Standard Reference Data Series National Bureau Standards No 33, May 1970. 32 p, 1 fig, 19 tab, 80 ref, 3 append.

Descriptors: *Electrical conductance, *Halogens, *Water, Electrolysis, Acids, Aqueous solutions, Ionization, Electrodes, Temperature, Theoretical analysis, Methodology.
Identifiers: Specific conductance, Hydrofluoric acid, Hydrochloric acid, Hydrobromic acid, Hydriodic acid.

Definitions, symbols, general principles, and general laws related to electrolytic conductance of aqueous solutions are presented. General laws considered are Coulomb's law for charged bodies, Poisson's equation relating electrostatic potential to charge distribution, and Stokes and Oseen laws for the velocity of a sphere in a fluid medium. Relations between electrical resistance, electrical conductance, specific resistance, specific conductance, and equivalent conductance are presented. Theoretical expressions for equivalent conductance as derived by Debye, Onsager, and Fuoss are given. General methods of treating equivalent conductances of ionophores and ionogens, especially in regard to determination of limiting equivalent conductance, degree of ionic association, and degree of ionic dissociation are discussed. Data on equivalent conductances of the halogen acids, hydrofluoric, hydrochloric, and hydriodic acids in water cover a wide range of concentration and temperature. (Woodard-USGS)
W71-02218

02. WATER CYCLE

2A. General

HYDROLOGY IN COLOMBIA,
Universidad de los Andes, Bogota (Columbia). Center of Technical Studies and Investigations in Hydraulics.
For primary bibliographic entry see Field 09A.
W71-02224

WORLD HYDROLOGY: STATUS AND PROSPECTS,
Geological Survey, Washington, D.C.
Raymond L. Nace.
In: Symposium on World Water Balance, Vol 1, International Association of Scientific Hydrology Publication No 92, p 1-10, July 1970. 10 p, 2 fig, 1 tab.

Descriptors: *Reviews, *Hydrology, *Hydrogeology, *International Hydrological Decade, Data collections, Sampling, Networks, Data processing, Analytical techniques, Hydrologic budget, Water balance, Synoptic analysis, Rainfall-runoff relationships, Hydrologic data.
Identifiers: Hydrologic data requirements.

Studies in hydrology in the IHD program are reviewed. Interpretation of hydrology and of the role of hydrologists in modern problems, however, must be very liberal, because water cannot be studied realistically independently of other factors in the environment, including biological factors. The ultimate aim of hydrological studies is to aid rational use of water for human purposes. Basic data are essential both for water development and for research. Basic data for all hydrological and related parameters are deficient for huge areas of the world and many development projects are being designed and constructed without an adequate base of data. Modern methods of systems simulation, data reduction, analysis and extrapolation make the apparent deficiencies in some kinds of data much less serious than they were a decade or two ago. New methods for quickly obtaining synoptic and sequential data for large areas also improve the prospects for world hydrology. (Knapp-USGS)
W71-02247

PRINCIPAL PROBLEMS OF MODERN HYDROLOGY,
State Hydrological Inst., Leningrad (USSR).
A. A. Sokolov.
In: Symposium on World Water Balance, Vol 1, International Association of Scientific Hydrology Publication No 92, p 10-19, July 1970. 10 p.

Descriptors: *International Hydrological Decade, *Water balance, *Water resources development, Hydrologic budget, Gaging stations, Hydrogeology, Data collections, Reviews.
Identifiers: USSR.

Water balance studies are being used in the USSR to design reservoir systems on large rivers. For this purpose, 15 hydrometeorological observatories were established. Surface-groundwater relationships, irrigated-land salt balance problems, swamp hydrology, waterlogging of soils, drainage projects, and man's influence on water balance are also studied by the use of hydrologic budget methods. The methods reviewed may be used anywhere, and cooperation between nations in the IHD is intended to help assure their value. (Knapp-USGS)
W71-02248

THE WATER BALANCE OF THE OCEANS,
Main Geophysical Observatory, Leningrad (USSR).
M. I. Budyko.
In: Symposium on World Water Balance, Vol 1, International Association of Scientific Hydrology Publication No 92, p 24-33, July 1970. 10 p, 2 tab, 30 ref.

Descriptors: *Water balance, *Oceans, Evaporation, Rainfall, Runoff, Hydrologic budget, International Hydrological Decade, Hydrologic cycle.
Identifiers: Oceanic water-balance.

Water exchange over the oceans has a determining influence on the water balance of our planet. Evaporation from the oceans amounts to 90% of the total evaporation from the earth's surface. The accuracy of estimating the components of the water balance of the Earth depends considerably on the accuracy of data on the water balance of the oceans. Several independent methods may be used to calculate precipitation and evaporation: (1) estimation of precipitation using observed data; (2) computation of precipitation; (3) estimation of evaporation without the use of data on radiation balance; (4) estimation of evaporation, taking into account computed radiation balance; and (5) estimation of evaporation, taking into account observed radiation balance. Estimation of evaporation without taking into account the data on radiation balance gives smaller values that seem to be less accurate than the results provided by the other 4 methods. In the World Ocean, estimated precipitation is 114 cm/yr, evaporation is 126 cm/yr, and inflow is 12 cm/yr. The total of precipitation and runoff for the Atlantic Ocean is smaller than the value of evaporation; the Atlantic Ocean receives water from other oceans, including the Arctic Ocean where evaporation is noticeably lower than the total of precipitation and runoff. (Knapp-USGS)
W71-02249

THE SCALE OF OCEANIC INFLUENCE ON CONTINENTAL PRECIPITATION,
Massachusetts Inst. of Tech., Cambridge. Dept. of Civil Engineering.
P. S. Eagleson, and R. F. Lariviere.
In: Symposium on World Water Balance, Vol 1, International Association of Scientific Hydrology Publication No 92, p 34-39, July 1970. 6 p, 1 fig, 2 tab, 4 ref.

Descriptors: *Precipitation (Atmospheric), *Synoptic analysis, *Climatology, Rainfall, Rainfall disposition, Meteorological data, Regions, Surveys, Weather data, Statistical methods, Hydrologic cycle, Data collections, Correlation analysis.
Identifiers: Continental rainfall distribution, North America.

The serial correlation coefficient of monthly point precipitation at lag one is examined for a common fifty year period at thirty-seven stations spanning the North American continent. The geographical distribution of these coefficients shows significant values along the Pacific (windward) coast which decay Eastward becoming insignificant near the Mississippi River. This is interpreted as defining the spatial scale of maritime influence over precipitation on a windward land mass. (Knapp-USGS)
W71-02250

WATER BALANCE - INDIAN OCEAN,
Physical Research Lab., Ahmedabad (India).
K. R. Ramanathan, and P. R. Pisharoty.
In: Symposium on World Water Balance, Vol 1, International Association of Scientific Hydrology Publication No 92, p 39-41, July 1970. 3 p.

Descriptors: *Water balance, *Indian Ocean, *Synoptic analysis, *Precipitation (Atmospheric), *Evaporation, Distribution patterns, Hydrologic cycle, Meteorological data, Precipitable water, Weather patterns, Oceans.
Identifiers: India, Water vapor flux.

The Indian Ocean provides the main moisture supply to the Southwest Monsoon, which causes abundant rainfall over India, Burma and Malaya. On the average, the precipitation and the evaporation appear to balance over the whole of the oceanic area on an annual basis. The annual evaporation is in excess of precipitation by more than 100 cm of water over parts of the Arabian Sea; the precipitation is in excess of evaporation by about 80 cm of water over considerable parts of the ocean off the Malayan and Indonesian Coasts. A significant portion of the moisture flux across the west coast of India is derived through evaporation from the Arabian Sea. The supply of water vapor to the Bay of Bengal branch of the Summer Monsoon appears to be derived through a northward flux across the equator east of longitude 70 deg E and through a westward flux across the Burma Malaya-Indonesian complex. Estimates of the net flux of water vapor into the Indian Sub-continent and the total rainfall over the same area, during a week of active monsoon, are respectively 2.06 times 10 to the 16th power and 2.14 times 10 to the 16th power gms per day. They appear to balance reasonably well. (Knapp-USGS)
W71-02251

THE HYDROLOGICAL CYCLE OF GREENLAND AND ANTARCTICA,
McGill Univ., Montreal (Quebec). Dept. of Meteorology.
Svenn Orvig.
In: Symposium on World Water Balance, Vol 1, International Association of Scientific Hydrology Publication No 92, p 41-49, July 1970. 9 p, 18 ref.

Descriptors: *Water balance, *Hydrologic cycle, *Glaciers, Synoptic analysis, Heat budget, Ablation, Hydrologic budget, Precipitation (Atmospheric), Regimen, Sea level, Water storage, Ice, Storms, Weather patterns.
Identifiers: Ice caps, Greenland, Antarctica.

The great ice caps of Greenland and Antarctica hold most of the 75% of the world's fresh water which is stored as glacier ice. Greenland holds about 2.4 million cu km water and antarctica 20 million cu km. If it all melted, the sea level would be raised about 70 m. The atmosphere holds little water vapor over the ice caps, due to the low temperature. Greenland receives most of its precipitation by upper portions of middle latitude cyclones which often cross the ice cap. In the Antarctic, cyclonic storms seldom penetrate the continent, except for the western part. Precipitation measurements are always difficult in the polar regions, so it is more useful to assess the net water accumulation. The Greenland ice cap balance is negative at present, about 85 cu km water/year. The Antarctic ice budget seems to be positive, with an annual net gain probably around 600 cu km water. Recent times have seen a relatively stable sea level, which indicates that the great ice caps are more or less in equilibrium. Physical-mathematical models can be used to examine the energy and water balances over the snow surfaces. (Knapp-USGS)
W71-02252

SNOW COVER ON THE TERRITORY OF THE USSR AS A WATER BALANCE ELEMENT,
Hydrometeorological Research Center, Moscow (USSR).
V. D. Komarov, and E. G. Popov.
In: Symposium on World Water Balance, Vol 1, International Association of Scientific Hydrology Publication No 92, p 49-54, July 1970. 6 p, 12 ref.

Descriptors: *Hydrologic budget, *Snowpacks, *Surveys, Remote sensing, Streamflow forecasting, Snowmelt, Hydrologic cycle, Heat budget, Reviews, Analytical techniques, Data collections.
Identifiers: USSR.

The influence of snow cover on river water regime and the hydrological cycle of the USSR is reviewed. Climatic conditions vary considerably; while some areas of the country are covered with snow for more than half a year, in other regions snow cover exists for less than a month. Over a major part of the lowland territory snow cover accumulates and remains for a period of 2 to 7 months. The winter average precipitation in the northern parts of the country amounts to 40-50% of the annual volume, in central parts the corresponding figure is about 30%, and in the south, about 15%. Snow cover observations have been conducted since 1892. Airsurvey and satellite surveillance are also used for mountain snow studies. A method of estimating the snowpack water equivalent in plains by means of airsurvey of natural soil gamma-radiation was developed in 1963. The standard error of the measured snowpack water equivalent at a 10 km course ranges from 5 to 7 mm or less than 10%. During the last few years the new method of snow cover survey has been systematically used in a number of river basins (the Volga, the Don, the Dnieper and others). (Knapp-USGS)
W71-02253

LAND GLACIATION PART IN THE EARTH'S WATER BALANCE,
Akademiya Nauk SSSR, Moscow. Institut Geografii.
V. M. Kotlyakov.
In: Symposium on World Water Balance, Vol 1, International Association of Scientific Hydrology Publication No 92, p 54-57, July 1970. 4 p, 1 tab, 9 ref.

Descriptors: *Water balance, *Glaciers, Regimen, Ablation, Melting, Ice, Hydrologic budget, Discharge (Water), Water storage, Antarctic.
Identifiers: Ice caps, Greenland.

The mean duration of water storage on mountain-valley glaciers 10 km long is several hundred years. In the central part of the Antarctic ice sheet, deep layers of ice are 100-200 thousand years old. At present, glaciers cover 16.2 million sq km, about 11% of the land surface. The mean depth of ice is 1700 m and the maximum is in excess of 4000 m in Antarctica. The total volume of glacial ice on the Earth is estimated at 27 million cu km. This is 99% of the ice on our planet. A major portion of the ice is concentrated in Antarctica and Greenland. The remaining glacial regions account for less than 1%, but that comparatively small amount of ice plays an important part in the water balance of the separate regions of the earth. The total ice discharge in Antarctica and Greenland makes up 8% of the Earth's streamflow. Liquid runoff is 330 cu km of water a year and the remaining 280 cu km are solid runoff (iceberg calving). The southern hemisphere icebergs spread to latitude 46-55 deg S., and their total volume in the World Ocean can be estimated at 50% of annual streamflow of the Earth. (Knapp-USGS)
W71-02254

THE ROLE OF UNDERGROUND FLOW IN THE WATER BALANCE OF THE USSR,
State Hydrological Inst., Leningrad (USSR).
B. I. Kudelin, I. S. Zektser, and O. V. Popov.
In: Symposium on World Water Balance, Vol 1, International Association of Scientific Hydrology Publication No 92, p 65-71, July 1970. 7 p, 1 tab, 6 ref.

Descriptors: *Water balance, *Groundwater movement, *Surface-groundwater relationships, Recharge, Discharge (Water), Runoff, Subsurface runoff, Streamflow, Hydrologic budget, Hydrogeology, Surveys.
Identifiers: USSR.

The mean groundwater flow to the rivers of the USSR equals about 24% of total streamflow and 9% of total precipitation. The total value of groundwater flow in the zone of active water exchange is 1,019 cu km per year. About 40% of the total precipitation on the territory of the USSR is discharged to rivers by surface and underground flow and 60% is lost by evaporation and deep underground flow. A short account is given of the main regularities of distribution of normal annual values of the modulus and coefficient of groundwater flow over the whole territory of the USSR and its individual regions. (Knapp-USGS)
W71-02255

EVALUATION OF THE GROUNDWATER BALANCE OF LARGE TERRITORIES,
All-Union Scientific Research Inst. of Hydrogeology and Engineering Geology, Moscow (USSR).
A. A. Konoplyantsev.
In: Symposium on World Water Balance, Vol 1, International Association of Scientific Hydrology Publication No 92, p 71-77, July 1970. 7 p, 1 fig, 8 ref.

Descriptors: *Water balance, *Groundwater, Synoptic analysis, Groundwater movement, Water storage, Water levels, Water level fluctuations, Surface-groundwater relationships, Runoff, Aquifers, Recharge, Hydrologic budget, Hydrogeology, Surveys.
Identifiers: USSR, Groundwater budget.

Calculation of the groundwater balance is essential to evaluation of the total water balance of large territories. To evaluate groundwater balance observation records of the groundwater regime, theoretically well-founded information of the change in the groundwater regime in area (in space) and cartographic measurement of changes in the groundwater balance on the territory are required. A good deal of work has already been done in this direction. These problems and studies are briefly reviewed. (Knapp-USGS)
W71-02256

ON THE ROLE OF UNDERGROUND STORAGE IN THE SETTING UP OF THE WATER BALANCE (FRENCH),
Gilbert Castany.
In: Symposium on World Water Balance, Vol 1, International Association of Scientific Hydrology Publication No 92, p 78-83, July 1970. 6 p, 2 fig, 2 tab.

Descriptors: *Water balance, *Water storage, *Aquifers, *Hydrogeology, Rainfall-runoff relationships, Recharge, Infiltration, Groundwater movement, Hydrologic cycle, Discharge (Water), Evapotranspiration, Soil water movement, Hydrologic budget.
Identifiers: Groundwater budget.

Groundwater storage plays an important quantitative and qualitative part in mainland water balance. The characteristics of the ground surface regulate the rainwater distribution into runoff and infiltration. The natural retention ability of the aquifer provides temporary storage, which partly regulates flow rates. A bulk of water, which is not entirely negligible, is regularized by storage underground. This storage period is often longer than the reference period used for the statistical analysis of basic data. Hydrogeology must be considered in any areal water balance study. (Knapp-USGS)
W71-02257

APPLICATION OF THE SSARR MODEL TO A BASIN WITHOUT DISCHARGE RECORD,
Weather Bureau, Salt Lake City, Utah. Western Region.
Vail Schermerhorn, and Donald W. Kuehl.
Available from NTIS as PB-194 394, $3.00 in paper copy, $0.95 in microfiche. Essa Technical Memorandum WBTM WR55, August 1970. 7 fig, 7 ref.
Identifiers: *Hydrology, Models, *Flood forecasting, Washington (State), Watersheds, Rainfall, Snowmelt, Surface water runoff, Soil water, Stream flow, Simulation, Computer programming, SSARR (Streamflow Synthesis and Reservoir Regulation), Skokumchuck River.

Hydrologic models are usually designed and tested on basins where high quality data are available with adequate areal and time coverage. In operational forecasting the model must be applied where the forecast is needed and not necessarily where all desired data are available. The SSARR (Streamflow Synthesis and Reservoir Regulation) model was designed to be a general, flexible model with special provisions for use in daily river forecasting operations. In the present application, the model is used to answer a need for flood forecast service on the Skookumchuck River at Centralia, Washington. Streamflow data consist of short period gage height records, but no discharge information except for smaller headwater areas. Precipitation must be estimated from two stations in an adjacent watershed.
W71-02297

FACTORS CONTRIBUTING TO UNUSUALLY LOW RUNOFF DURING THE PERIOD 1962-68 IN THE CONCHO RIVER BASIN, TEXAS,
Geological Survey, Austin, Tex.
For primary bibliographic entry see Field 02E.
W71-02448

A SURVEY OF WATER BALANCE PROBLEMS, PROJECTS AND PROGRESS IN ALBERTA,
Meteorological Service of Canada, Calgary (Alberta). Watershed Research Program.
D. Storr.
In: Symposium on World Water Balance, Vol 2, International Association of Scientific Hydrology Publication No 93, p 314-324, July 1970. 11 p, 2 fig, 18 ref.

Descriptors: *Water balance, *Synoptic analysis, *Project purposes, *International Hydrological Decade, Hydrologic budget, Hydrologic cycle, Reviews, Meteorology, Topography, Precipitation (Atmospheric), Runoff, Vegetation, Water storage, Evapotranspiration, Climatic data, Streamflow.
Identifiers: *Alberta (Canada).

Projects concerning water balance problems in Alberta, Canada are evaluated. Although termed one of the 'Prairie Povinces', less than 15% of the area can be called prairie. North of latitude 55 degrees most of the area is forest, lake, and swamp with only small enclaves of agricultural land. Similarly, the Rocky Mountains with heights up to 12,000 feet and their forested foothills remove a large portion of the southwest from the prairie classification. Human habitation, and hence hydrologic observation, is confined mainly to the agricultural area as there are only pockets of settlement in the northern forests and the mountain valleys. Most settlement has occurred since 1900 so the history of the hydrologic sciences in Alberta is quite limited. In the hydrologic sense, Alberta could therefore be classed with the 'developing countries'. Estimating precipitation, surface runoff, evapotranspiration and storage changes for such a nonhomogeneous area presents many problems. The achievement of a provincial water balance is hindered by large gaps in knowledge of basic hydrologic parameters. If a balance could be achieved by each of the ten I.H.D. projects considered, the relationships obtained would promote the achievement of a balance on the provincial scale. (Woodard-USGS)
W71-02458

WATER-BALANCE IN THE FEDERAL REPUBLIC OF GERMANY,
Freiburg Univ. (West Germany).
Reiner Keller.
In: Symposium on World Water Balance, Vol 2, International Association of Scientific Hydrology Publication No 93, p 300-314, July 1970. 15 p, 6 fig, 1 tab, 14 ref.

Descriptors: *Water balance, *Foreign projects, Hydrologic cycle, Evapotranspiration, Precipitation (Atmospheric), Hydrologic budget, Meteorology, Surface waters, Synoptic analysis, Equations, Vegetation, Groundwater, Runoff, Water storage, Solar radiation, Soil properties, International Hydrological Decade.
Identifiers: *Federal Republic of Germany.

The calculation of the plan of water balance is divided into four steps: (1) Determination of the mean precipitation; (2) estimation of transpiration according to a special procedure and determination of evapotranspiration; (3) the total run-off obtained from the difference between recorded precipitation and calculated evapotranspiration; and (4) water demands of industry and municipalities. In the interpretation of the water-balance in the Federal Republic of Germany there are various conceptions which touch upon hypotheses and problems of ecological regional investigations. The close correlation between the ecological potential of a region and water-consumption, or evapotranspiration is controlled by the balance of radiation and soil characteristics. (Woodard-USGS)
W71-02459

METHODS FOR THE COMPUTATION OF WATER BALANCE OF RESERVOIRS,
State Hydrological Inst., Leningrad (USSR).
For primary bibliographic entry see Field 07C.
W71-02460

GENERAL SCHEME FOR CALCULATING THE WATER BALANCE OF CLOSED INLAND SEAS AND LAKES BY THE METHOD OF STATISTICAL MODELLING,
Georgian Power Research Inst., Tiflis (USSR).
For primary bibliographic entry see Field 02H.
W71-02461

STORAGE IN THE WATER BALANCE OF THE LAKE ONTARIO BASIN,
Department of Energy, Mines and Resources, Cornwall (Ontario). Inland Waters Branch.
For primary bibliographic entry see Field 02H.
W71-02462

METHODS FOR COMPILATION OF CURRENT WATER BALANCES OF RIVER DRAINAGE BASINS IN THE USSR,
State Hydrological Inst., Leningrad (USSR).
A. P. Bochkov, and A. B. Zavodchikov.
In: Symposium on World Water Balance, Vol 2, International Association of Scientific Hydrology Publication No 93, p 274-280, July 1970. 7 p, 1 tab, 5 ref.

Descriptors: *Water balance, *Methodology, *Watersheds (Basins), Mathematical studies, Equations, Hydrologic cycle, Meteorology, Hydrologic budget, Synoptic analysis, Streamflow, Vegetation, Evapotranspiration, Water storage, Precipitation (Atmospheric), Groundwater, Surface waters, Soil water movement, Runoff, International Hydrological Decade.
Identifiers: *USSR.

In Russia water balances are computed for each month, season, and year for about 200 river basins including both large river systems and small experimental watersheds. However, due to the fact that the number of observation points for measuring various water balance components is not sufficient, computation of water balance for big rivers is performed by means of a simplified water-balance equation. Methods and examples of water balance computations are presented. (Woodard-USGS)
W71-02463

VERTICALLY DIFFERENTIATED WATER BALANCE IN TROPICAL HIGH MOUNTAINS - WITH SPECIAL REFERENCE TO THE SIERRA NEVADA DE SANTA MARTA/COLOMBIA,
Reimer Herrmann.
In: Symposium on World Water Balance, Vol 2, International Association of Scientific Hydrology Publication No 93, p 262-273, July 1970. 12 p, 3 fig, 15 ref.

Descriptors: *Water balance, *Mountains, *Tropical regions, Hydrologic budget, Hydrologic cycle, Precipitation (Atmospheric), Soil moisture, Soil water movement, Evaporation, Runoff, Rainfall, Vegetation, Forests, Meteorology, Evapotranspiration, Slopes, Streamflow, Watersheds (Basins), Synoptic analysis, International Hydrological Decade.
Identifiers: *Columbia (South America).

The hydrological vertical zonation of tropical high mountains depends on their situation within the general circulation and on climatic differentiation caused by local exposure. Thus a variety of different hydrological altitudinal zones exists. The lee type sequence of the trade wind zone is explained using the northwestern Sierra Nevada de Santa Marta/Colombia as an example. The Sierra climbs steeply direct from sea level to a height of approx. 6000 m. The profile begins with the region of the driest climate on the Caribbean coast. This dry climate is caused by dry, hot katabatic winds (R. Herrmann 1970b), stress-differential induced divergence (R.A. Bryson and P.M. Kuhn 1961) and leeside divergence (F. Lahey 1958). As the dry katabatic winds are limited to the coastal heights and the floodplain of the Rio Gaira in the profile, and as at growing distance from the coast the stress-differential induced divergence and the leeside divergence diminish, there develops strong slope convergence connected with higher tendency for rainfall. By means of the least square method the vertical variation of rainfall may be described making it easy to find the height of maximum rainfall at 1660 m. But above this in the zone of tropical ombriphilous cloud forest there is additional rainfall by fog drip, which indicates that the hydrological effective maximum may be at a height of about 2300 m. The whole survey was made among natural plant formations or among secondary plant formations similar to the natural ones. The vertical zonation of the water balance follows the vertical zonation of plant formations beginning at sea level. The soil moisture pressure dynamics are explained by means of isopleths. (Woodard-USGS)
W71-02464

COMMENTS ON WATER BUDGET INVESTIGATIONS, ESPECIALLY IN TROPICAL AND SUBTROPICAL MOUNTAIN REGIONS,
Bonn Univ. (West Germany).
H. Flohn.
In: Symposium on World Water Balance, Vol 2, International Association of Scientific Hydrology Publication No 93, p 251-262, July 1970. 12 p, 4 fig, 2 tab, 26 ref.

Descriptors: *Water budget, *Mountains, *Subtropic, *Tropical regions, Water balance, Hydrologic budget, Hydrologic cycle, Water vapor, Streamflow, Runoff, Model studies, Equations, Precipitation (Atmospheric), Valleys, Meteorology, Synoptic analysis, International Hydrological Decade.
Identifiers: *Surface energy, South America, Africa, Southern Asia.

Three different techniques are used to evaluate the water budget of a given area: hydrological balance, surface energy budget, and evaluation of the divergence of the atmospheric water vapor transport. Due to deficiencies of available observations, relatively large systematic and random errors are unavoidable and necessitate the comparative (and critical) use of different techniques. In tropical and subtropical mountains local daytime circulations lead to a systematic underestimate of rainfall measured at most valley stations. In contrast to the daytime circulations, the effect of the reversed nighttime circulations on the precipitation pattern is much more infrequent. Some examples are demonstrated. (Woodard-USGS)
W71-02465

MEANING OF WATER BALANCE IN WARM HUMID ISLANDS,
National Research Center for Disaster Prevention, Tokyo (Japan).
M. Sugawara.
In: Symposium on World Water Balance, Vol 2, International Association of Scientific Hydrology Publication No 93, p 243-250, July 1970. 8 p, 6 fig, 1 tab.

Descriptors: *Water balance, Humid areas, *Hydrologic cycle, Hydrologic budget, Floods, Meteorology, Streamflow, Model studies, Rainfall, Runoff, Water resources, Evaporation, Synoptic analysis, International Hydrological Decade, Foreign projects.
Identifiers: *Japan.

Annual precipitation is much greater than annual evapotranspiration on Japan's warm humid islands. Heavy storms and floods are frequent. Therefore, if we make a balance sheet of water, large errors may be on both sides, one from the heavy storm another from the flood. A way of avoiding this defect is to classify the precipitation and the discharge by their quantities. Then heavy storms may correspond mainly to floods and their large errors cancel each other. This classification merely by the quantity has some defects, because it does not contain the concept of time. One way to consider the effect of time is to classify the precipitation by runoff models. This method is especially important in humid regions where the greater part of precipitation turns into surface discharge. Classification of precipitation and discharge is important not only for avoiding the errors as described, but also for the water use. (Woodard-USGS)
W71-02466

EVALUATION OF RESOURCES OF SHALLOW AQUIFIERS (IN FRENCH),
R. Degallier, and C. Joseph.
English, Spanish and Russian abstracts. In: Symposium on World Water Balance, Vol 1, International Association of Scientific Hydrology Publication No 92, p 84-99, July 1970. 16 p, 5 plate, 1 tab, 5 ref.

Descriptors: *Water levels, *Water level fluctuations, *Water balance, *Groundwater, *Computer programs, Rainfall, Surface-groundwater relation-

ships, Hydrologic cycle, Antecedent precipitation, Infiltration, Aquifers, Mathematical models, Water storage.
Identifiers: Rainfall-recharge relationships.

Excellent correlations have been obtained between rainfall cumulative departure curves and ground water levels, in climates as different as those of Sahara, equatorial forest, African savannah and France. The rainfall function may include a phase-shifting module simulating the time for transfer through the soil, a threshold module excluding the small showers in periods of soil moisture deficit, a subroutine stopping the correlation when the water table has reached the soil surface, and a possibility of taking into account either increasing or decreasing water levels. Applications of the method are shown and a FORTRAN computation program is appended. This method can help to predict groundwater level fluctuations and can compare groundwater recharge over long distances. (Knapp-USGS)
W71-02467

WATER RESOURCES RESEARCH IN MINNESOTA BY THE NORTH CENTRAL FOREST EXPERIMENT STATION,
Forest Service (USDA), St. Paul, Minn. North Central Forest Experiment Station.
Roger R. Bay.
Proc Conference on Ongoing Water Resources Research in Minnesota, March 1970. Univ of Minn. Water Resources Research Center Bul 21, p 40-56, June 1970.

Descriptors: *Bogs, *Organic soils, *Peat, *Minnesota, *Wetlands, Swamps, Demonstration watersheds, Streamflow, Forestry, Groundwater, Evapotranspiration, Soil physical properties, Water table, Water yield improvement.
Identifiers: *Peatlands, *Wetland hydrology, *Experimental watersheds, Forest hydrology, Watershed management research.

Describes general research in peatland hydrology conducted by the U.S. Forest Service in northern Minnesota. Experimental watershed studies on individual peat bog basins are concerned with water quantity and water quality from natural bog areas and as influenced by forestry practices. Other studies include the relationship between local groundwater systems and bog water tables, the investigation of physical and hydrologic properties of organic soils, and evapotranspiration and energy balance measurements on various bog vegetation systems. (Bay-Forest Service)
W71-02750

2B. Precipitation

THE SCALE OF OCEANIC INFLUENCE ON CONTINENTAL PRECIPITATION,
Massachusetts Inst. of Tech., Cambridge. Dept. of Civil Engineering.
For primary bibliographic entry see Field 02A.
W71-02250

WATER BALANCE - INDIAN OCEAN,
Physical Research Lab., Ahmedabad (India).
For primary bibliographic entry see Field 02A.
W71-02251

AREAL COVERAGE OF PRECIPITATION IN NORTHWESTERN UTAH,
Weather Bureau, Salt Lake City, Utah. Western Region.
Philip Williams, Jr., and Werner J. Heck.
Available from NTIS as PB-194 389, $3.00 in paper copy, $0.95 in microfiche. Essa Technical Memorandum WBTM WR56, Sept. 1970. 20 p, 8 tab, 5 fig, 3 ref.
Identifiers: *Atmospheric precipitation, *Utah, Probability, Networks, Weather forecasting, Periodic variations, Weather stations, Accuracy.

Areal coverage of precipitation in a dry region, such as northwestern Utah would be expected to be lower than in a moist area like Kentucky. This small areal coverage would have a marked effect on the degree to which Salt Lake City PoP forecasts could improve over climatological forecasts. The purposes of this study are to determine: (1) the frequency distribution of areal coverage on percipitation days in northwestern Utah during various seasons of the year, and (2) the maximum possible improvement of forecast Brier Scores over climate Brier scores.
W71-02298

GROUND RAINFALL DATA FOR THE 1968 FLORIDA CLOUD SEEDING EXPERIMENT,
Environmental Data Service, Silver Spring, Md.
For primary bibliographic entry see Field 03B.
W71-02301

SNOWFALL, SNOWFALL FREQUENCIES, AND SNOW COVER DATA FOR NEW ENGLAND,
Environmental Data Service, Silver Spring, Md.
R. E. Lautzenheiser.
Available from NTIS as PB-194 221, $3.00 in paper copy, $0.95 in microfiche. Essa Technical Memorandum EDSTM 12, December 1969. 15 p, 2 tab, 8 fig.

Descriptors:
Identifiers: *Snowfall, Statistical data, *Snow cover, Seasonal variations, Maine, New Hampshire, Vermont, Massachusetts, Connecticut, Rhode Island.

Seasonal total snowfall averages and extremes, frequencies of various snowfall intensities from 1 to 8 inches in a day, and snow cover data are presented in a series of 8 maps and 2 tables. Some notes on difficulties in obtaining good snowfall data are included. Nearly 100 stations were studied for snowfall frequency and snow cover data, using around 30 years of record per station if available. None with less than 10 years of record were used. Results show a several-fold increase in seasonal snowfall, in days with 1 inch or more of snowfall, and in maximum snow cover depth, from the southeastern coastal area to the north and to higher elevations. Frequencies of heavy snowfalls, of 8 inches or more in a day, however, are more uniform over New England, averaging mostly once or twice a year. The monthly distribution of 1 and 4 inch daily snowfalls are shown.
W71-02303

A STUDY OF THE PRODUCTION AND DETECTION OF ARTIFICIAL ICE NUCLEI,
Denver Research Inst., Colo.
For primary bibliographic entry see Field 03B.
W71-02304

VERTICALLY DIFFERENTIATED WATER BALANCE IN TROPICAL HIGH MOUNTAINS - WITH SPECIAL REFERENCE TO THE SIERRA NEVADA DE SANTA MARTA/COLOMBIA,
For primary bibliographic entry see Field 02A.
W71-02464

COMMENTS ON WATER BUDGET INVESTIGATIONS, ESPECIALLY IN TROPICAL AND SUBTROPICAL MOUNTAIN REGIONS,
Bonn Univ. (West Germany).
For primary bibliographic entry see Field 02A.
W71-02465

MEANING OF WATER BALANCE IN WARM HUMID ISLANDS,
National Research Center for Disaster Prevention, Tokyo (Japan).
For primary bibliographic entry see Field 02A.
W71-02466

CALCULATION OF PRECIPITABLE WATER,
Weather Bureau, Silver Spring, Md. Techniques Development Lab.
L. P. Harrison.
Available from NTIS as PB-193 600, $3.00 in paper copy, $0.95 in microfiche. Essa Technical Memorandum WBTM TDL 33, June 1970. 61 p, 3 fig, 3 tab, 118 ref.
Identifiers: *Atmospheric precipitation, Measurement, Radiosondes, Water vapor, Boundary value problems, Dew point, Humidity.

Two methods of calculating precipitable water are given in terms of data obtainable from a radiosonde or rawinsonde observation. Method I is based on the premise that aqueous vapor pressure (or dew point) and temperature are reported for determined geopotential levels or geometric altitudes with reference to mean sea level; while Method II is predicated on the basis that aqueous vapor pressure (or dew point) is reported for respective specified barometric pressure levels whose geopotentials are computed by means of the data obtained in the sounding. Thus, under Method I the precipitable water is calculated by numerical integration such that the variable of integration is either geopotential or geometric altitude, and under Method II it is calculated by such a procedure that the variable of integration is pressure. In either case one may choose to assume arbitrarily that the acceleration of gravity g is constant, thus implicitly giving rise to a small systematic error; or one may treat the problem in a more accurate manner by taking g as a known function of latitude and geopotential (or geometric altitude). Procedures covering all of these alternatives are presented.
W71-02608

2C. Snow, Ice, and Frost

THE HYDROLOGICAL CYCLE OF GREENLAND AND ANTARCTICA,
McGill Univ., Montreal (Quebec). Dept. of Meteorology.
For primary bibliographic entry see Field 02A.
W71-02252

SNOW COVER ON THE TERRITORY OF THE USSR AS A WATER BALANCE ELEMENT,
Hydrometeorological Research Center, Moscow (USSR).
For primary bibliographic entry see Field 02A.
W71-02253

LAND GLACIATION PART IN THE EARTH'S WATER BALANCE,
Akademiya Nauk SSSR, Moscow. Institut Geografii.
For primary bibliographic entry see Field 02A.
W71-02254

2D. Evaporation and Transpiration

THE WATER BALANCE OF THE OCEANS,
Main Geophysical Observatory, Leningrad (USSR).
For primary bibliographic entry see Field 02A.
W71-02249

ATMOSPHERIC-AND SOIL-INDUCED WATER STRESSES IN PLANTS AND THEIR EFFECTS ON TRANSPIRATION AND PHOTOSYNTHESIS,
Agricultural Research Service, Phoenix, Ariz. Water Conservation Lab.
S. B. Idso.
Journal of Theoretical Biology, Vol 21, p 1-12, 1968. 9 fig, 11 ref.

Descriptors: *Photosynthesis, *Transpiration, *Moisture stress, *Humidity, *Soil-water-plant

relationships, Soil water, Irrigation practices, Free energy, Leaves, Thermodynamic behavior, Soil structure, Soil properties, Theoretical analysis, Root systems, Moisture tension, Atmosphere, Soil physical properties, Vapor pressure, Moisture deficit, Rates of application.
Identifiers: *Diffusion pressure deficit (DPD), *Water potential, Chloroplasts, Evaporative demand.

It is proposed that the general phenomenon of 'water stress' is composed of 2 nearly independent phenomena involving photosynthesis and transpiration. Developing appropriate theoretical considerations, it is shown that plant diffusion pressure deficit (DPD) may be lowered by a maximum of only 2 atm by increasing relative humidity (or decreasing evaporative demand) from 40-98%. Alternatively, photosynthesis, which is a function of the absolute free energy of water in the vicinity of chloroplasts, varies from 0-23 atm DPD, which may be traversed by changing the free energy of the soil moisture from 0 to 2 or 3 atm. From these and similar considerations, it is concluded that photosynthesis is 90% decoupled from atmospheric moisture and transpiration is independent of soil moisture to a similar degree. It is then shown from the data of various workers that, owing to these differing stress factors, photosynthetic rates may increase in response to water applications that have already effected maximum transpiration rates. These ideas are discussed as factors in irrigation practices and it is felt that in certain situations where other factors, such as soil properties and light intensity are favorable, repeated water applications beyond maximum transpiration levels may result in higher irrigation yields. (Casey-Arizona)
W71-02508

INTRASPECIFIC DIFFERENCES IN TEMPERATURE-INDUCED RESPIRATORY ACCLIMATION OF DESERT SALTBUSH,
California Univ., Riverside. Dept. of Agronomy.
N. J. Chatterton, C. M. McKell, and B. R. Strain.
Ecology, Vol 51, No 3, p 545-547, Late Spring 1970. 3 fig, 1 tab, 9 ref. NSF Grant GB-7230.

Descriptors: *Xerophytes, *Respiration, *Carbon dioxide, *Ecotypes, *Environmental effects, Acclimitization, Cold resistance, Physiological ecology, Photosynthesis, Laboratory tests, California, Arizona, Temperature, Heat resistance, Metabolism, Plant growth, Plant physiology, Mode of action, Southwest U.S., Arid lands, Desert plants, Fluctuation.
Identifiers: *Saltbush, *Gas exchange, *Plant adaptations.

High temperatures during growth in plants result in higher photosynthesis temperature optima than when grown at lower temperatures. This is thought to be a multiple biochemical mechanism somatic tissue adaptation which facilitates organismic compensation for seasonal environmental fluctuations. It is unclear to what extent this adaption is controlled by genetic properties. The desert saltbush (Atriplex polycarpa) is distributed widely in southwestern deserts of differing mean annual temperatures. Plants were grown from seeds of 3 isolated populations from areas of differing mean temperature and preconditioned in 3 temperature regimes (5-16 deg. C., 21-32 deg. C. and 32-43 deg. C.). Dark respiration as measured by carbon dioxide evolution was determined in each temperature range (5, 10, 25 and 40 deg. C.). Results indicated that plants from warm areas had less capacity to adapt to cold temperatures than plants from cold areas. This suggests intraspecific differences in acclimation potential. (Casey-Arizona)
W71-02514

TRITIUM COLLECTION AND EXTRACTION TECHNIQUES FOR PLANT-WATER RELATIONSHIP STUDIES,
Texas A and M Univ., College Station. Dept. of Range Science.
S. E. Young, J. D. Dodd, and E. R. Ibert.
Ecology, Vol 51, No 3, p 535-537, Late Spring 1970. 3 fig, 10 ref. AEC Contract No AT- (40-1)-3488.

Descriptors: *Tritium, *Radioactivity techniques, *Laboratory equipment, *Transpiration, *Cacti, Xerophytes, Vacuum drying, Quenching, Tracers, Freeze drying, Water balance, Water vapor, Water loss, Vapor pressure, Plant tissues, Analytical techniques, Water circulation.
Identifiers: *Hygrothermographs, *Vapor pressure deficit, Plant-water relationships, Combustion.

The advantages of tritium as a plant-water tracer are outlined. Tracer techniques were developed for measuring water movement and water loss in the pricklypear cactus (Opuntia spp.). Plants were injected with tritiated water of varying specific activities. Transpired vapor was collected by using a vacuum pump to pass dry air over the plant surface and into collecting vials. Hygrothermograph recordings were used to determine vapor pressure deficit values. Tissue water was extracted by freeze-drying in cold water and by warm water. Combustion values obtained indicated this tracer technique is effective when extraction time is 8 hrs. With slight equipment modifications, the technique should be applicable to other plant species. (Casey-Arizona)
W71-02516

2E. Streamflow and Runoff

ERROR CRITERIA IN WATER SURFACE PROFILE COMPUTATIONS,
Massachusetts Inst. of Tech., Cambridge. Dept. of Civil Engineering.
Edward A. McBean, and Frank E. Perkins.
Available from NTIS as PB-196 120, $3.00 in paper copy, $0.95 in microfiche. Massachusetts Institute of Technology Hydrodynamics Laboratory Report No 124, June 1970. 167 p, 25 fig, 20 tab, 25 ref, 3 append. OWRR Project C-1495 (No 1988), (3).

Descriptors: *Mathematical studies, *Streamflow, *Flow profiles, *Water levels, *Stage-discharge relations, Data processing, Equations, Mathematical models, Computer programs, Numerical analysis, Programming languages, Mannings equation, Channel morphology, Supercritical flow, Turbulent flow, Profiles.
Identifiers: *Error calculations, *Backwater profiles.

Numerical error generation properties and the effects of data uncertainty are analyzed for several of the most common methods used in water surface profile computations. Theoretical equations are developed that serve as bounds on the actual errors that are introduced during the computation. The analysis also provides criteria which may be used in the rational selection of the calculation increment. In most engineering applications the effect of numerical errors on the computed profile will be considerably smaller than that due to data uncertainty. When numerical error generation is significant, it is predictable through the error bound equations. The successive substitutions algorithm, presently used in most computer programs for convergence of the iteration scheme, sometimes encounters difficulties due to convergence to incorrect profiles and failure to converge; application of the bisection algorithm eliminates these problems. (Knapp-USGS)
W71-02201

NUMERICAL SOLUTION OF UNSTEADY FLOWS IN OPEN CHANNELS,
Massachusetts Inst. of Tech., Cambridge. Dept. of Civil Engineering.
Daniel J. Gunaratnam, and Frank E. Perkins.
Available from NTIS as PB-196 159, $3.00 in paper copy, $0.95 in microfiche. Massachusetts Institute of Technology Hydrodynamics Laboratory Report No 127, July 1970. 259 p, 76 fig, 11 tab, 42 ref, 4 append. OWRR Project C-1495 (No 1988), (2).

Descriptors: *Routing, *Computer programs, *Open channel flow, *Unsteady flow, *Equations, Streamflow forecasting, Water storage, Flood forecasting, Runoff forecasting, Linear programming, Waves (Water), Tides, Bores, Tidal effects, Hydraulic models.
Identifiers: *Unsteady open channel flow.

A finite difference scheme was developed to integrate the St. Venant Equations over a wide range of transient flow conditions. The scheme was incorporated into a useful computer program. Systematic testing compared the difference scheme with observed data and linearized analytical solutions. The weighted residual method using the Galerikan technique of minimizing proved to be a relatively simple method for deriving a minimum error finite difference scheme. Solution of the set of simultaneous algebraic equations generated by the implicit difference scheme was effected using the influence function method. This provides a very efficient procedure for solving the equations associated with a network of channels. (Knapp-USGS)
W71-02202

PHOTOMICROSCOPIC SUBLAYER VELOCITY MEASUREMENT,
Illinois Univ., Urbana. Dept. of Civil Engineering; and Waterways Experiment Station, Vicksburg, Miss.
For primary bibliographic entry see Field 08B.
W71-02206

IMPLICIT FLOOD ROUTING IN NATURAL CHANNELS,
North Carolina State Univ., Raleigh. Dept. of Civil Engineering; and Virginia Inst. of Marine Science, Gloucester Point.
Michael Amein, and Ching S. Fang.
ASCE Proceedings, Journal of the Hydraulics Division, Vol 96, No HY12, Paper 7773, p 2481-2500, December 1970. 20 p, 10 fig, 1 tab, 24 ref, append. OWRR Project A-001-NC.

Descriptors: *Flood routing, *Computer programs, *Open channel flow, *Unsteady flow, Mathematical models, Numerical analysis, Digital computers, Floods, Channel morphology, Linear programming.
Identifiers: Implicit flood-routing methods.

Flood routing and many other applications in hydraulic engineering are based on the solution of the equations of unsteady flow and require fast and accurate numerical methods. An implicit numerical method which is both fast and accurate can be established on the basis of: (1) A centered difference scheme to represent the primary differential equations in finite difference form; and (2) the simultaneous solution of the finite difference equations for each time step. The difference equations constitute a system of nonlinear algebraic equations which can be solved on a digital computer by Newton iteration method. The computational scheme becomes very efficient when advantage is taken of the sparseness of the matrix of coefficients of the linear systems employed in the iteration. Applications of the implicit method show that it can be conveniently used for highly irregular channels. (Knapp-USGS)
W71-02207

WATER RESOURCES DATA FOR COLORADO 1969: PART 1. SURFACE WATER RECORDS.
Geological Survey, Denver, Colo. Water Resources Div.
For primary bibliographic entry see Field 07C.
W71-02246

HYDROGEOLOGIC DATA FOR THE SOUTHWESTERN COASTAL RIVER BASINS, CONNECTICUT,
Geological Survey, Hartford, Conn.

Mendall Thomas, Robert B. Ryder, and Chester E. Thomas, Jr.
Connecticut Water Resources Bulletin No 18, 1969. 45 p, 2 fig, 1 plate, 8 tab, 16 ref.

Descriptors: *Water resources, *Water quality, *Hydrologic data, *Connecticut, Surface waters, Groundwater, Chemical analysis, Observation wells, Water levels, Streamflow, Flow rates, Precipitation (Atmospheric), Lakes, Reservoirs, Data collections, Hydrogeology.
Identifiers: *Basic data.

Hydrologic and geologic data collected by the U.S. Geological Survey during an investigation of water resources in cooperation with the Connecticut Water Resources Commission is presented. These basins occupy about 394 square miles in Connecticut and 46 square miles in New York, including the towns of Greenwich, Stamford, Darien, New Canaan, Norwalk, Wilton, Westport, Weston, Fairfield, Easton, and Bridgeport, and parts of Danbury, Ridgefield, Redding, Bethel, Newtown, Trumbull, Monroe, Shelton, and Stratford. The data include records of 391 wells, graphical logs of 144 wells and 319 test holes, laboratory analyses of the grain size of 39 samples of stratified drift, and data from 5 pumping tests. Partial records of streamflow were collected at 19 gaging stations. At these gaging stations, from 1 to 18 discharge measurements and from 1 to 40 stage measurements were made during the period September 1960 to September 1965. From stage-discharge relationships based upon the discharge measurements, discharges were determined corresponding to the stages measured. A list of discharge determinations for all partial-record gaging stations is included, and chemical quality analyses are tabulated. (See also W71-01912). (Woodard-USGS)
W71-02259

FLOOD PLAIN INFORMATION, CITY OF ALEXANDRIA AND ARLINGTON COUNTY, VIRGINIA, FOURMILE RUN.
Corps of Engineers, Baltimore, Maryland.
For primary bibliographic entry see Field 04A.
W71-02285

FOUR-POINT METHOD OF CHARACTERISTICS,
Technische Hogeschool, Delft (Netherlands).
For primary bibliographic entry see Field 08B.
W71-02431

PERIODIC PERMANENT ROLL WAVES,
California Univ., Irvine. Dept. of Civil Engineering.
For primary bibliographic entry see Field 08B.
W71-02432

COMPUTATION OF OPEN-CHANNEL SURGES AND SHOCKS,
Thessaloniki Univ., Salonika (Greece). School of Agriculture; and California Univ., Davis. Dept. of Water Science.
George Terzidis, and Theodor Strelkoff.
ASCE Proceedings, Journal of the Hydraulics Division, Vol 96, No HY12, Paper 7780, p 2581-2610, December 1970. 30 p, 16 fig, 32 ref, append. OWRR Project B-037-CAL.

Descriptors: *Surges, *Bores, *Unsteady flow, *Supercritical flow, Mathematical models, Hydraulic models, Open channel flow, Waves (Water), Computer models, Hydraulic jump.
Identifiers: *Open channel shocks, Method of characteristics.

Unsteady flows in fixed-bed open channels are computed on the basis of the same assumptions as those for steady, gradually varied flow, the key one being hydrostatic pressure distribution in every cross section. The St. Venant equations for this case commonly are solved either by the method of characteristics or by finite differences in a rectangular network. Positive waves are characterized by converging characteristics; once these intersect a bore or shock forms, and many customary methods of solution fail. The equations of motion for flow with and without shocks are compared, the generation of bores is analyzed by exact solution of characteristic equations, and several numerical schemes are presented for through-computation of unsteady flows that may contain shock zones. Comparison is made between computed results and experimental data gathered for a variety of cases; corroboration is generally good. (Knapp-USGS)
W71-02433

POTAMOLOGY DATA COLLECTION ON LOWER MISSISSIPPI RIVER,
Army Engineer District, Vicksburg, Miss. River Stabilization Branch.
Charles M. Elliott.
ASCE Proceedings, Journal of the Waterways, Harbors and Coastal Engineering Division, Vol 96, No WW3, Paper 7466, p 601-622, August 1970. 22 p, 14 fig, 4 ref.

Descriptors: *Data collections, *Hydrologic data, *Potamology, *Mississippi River, Sediment transport, Sedimentary structures, Channel morphology, River training, Flood control, Hydrography, Navigation, Surveys, Stream gages, Gaging stations.
Identifiers: *Potamology data.

The potamology data collection program of the U. S. Army Corps of Engineers, Vicksburg District, is designed to provide adequate, dependable data on the behavior of the Lower Mississippi River. The data are being used to establish guidelines for effectively and economically stabilizing the river for flood control and navigation. Channel stabilization problems involve not only the most feasible means of stabilizing specific reaches of the river, but also long-range predictions of natural and man-caused changes in river regime. The data being collected are hydrographic surveys, bed form profiles, current direction, discharge and horizontal velocity distribution, bed material and suspended sediment samples, and water surface profiles. Emphasis is placed on standardized data documentation in order to minimize the amount of time necessary to prepare the data for study and to enable personnel who are relatively unfamiliar with the details of the program to use the data confidently. (Knapp-USGS)
W71-02438

FACTORS CONTRIBUTING TO UNUSUALLY LOW RUNOFF DURING THE PERIOD 1962-68 IN THE CONCHO RIVER BASIN, TEXAS,
Geological Survey, Austin, Tex.
Stanley P. Sauer.
Geological Survey Open-file Report (Texas Dist Rep No 112), August 1970. 85 p, 29 fig, 16 tab, 26 ref.

Descriptors: *Droughts, *Runoff, *Low flow, *Evaluation, *Texas, Hydrologic data, Surface waters, Streamflow, Flow rates, Water yield, Consumptive use, Vegetation, Rainfall-runoff relationships, Climatology, Topography, Maps, Hydrographs, Statistical methods, Groundwater, Groundwater movement.
Identifiers: *Concho River basin (Tex).

To determine the reasons for the unusually low runoff in the Concho River basin during the period 1962-68, the physical developments and climatic changes in the basin were identified and related to changes in the regimen of streamflow. Land use, brush infestation, and land-treatment practices have not caused significant changes in the rainfall-runoff relationship. The use of surface-water for irrigation has increased very little during the past 70 years, and although the use of groundwater for irrigation has greatly increased in the past 25 years, springflow has not been significantly diminished. The base flow of the streams is materially reduced by surface-water irrigation diversions. Diversions for municipal and industrial use have increased rapidly, but these diversions affect only the streamflow downstream from San Angelo. The analyses c rainfall-intensity and runoff data indicate that th basic cause for the relatively low runoff during th period 1962-68 was the lack of high-intensity long duration storms. Coefficients of variation range from 0.8 to 1.4, and first-order serial correlation ranged from 0.01 to 0.28. Drought recurrence in terval of the report period is about 200 years (Woodard-USGS)
W71-02448

WATER-RESOURCES INVENTORY SPRING 1968 TO SPRING 1969--ANTELOPE VALLEY-EAST KERN WATER AGENCY AREA, CALIFORNIA,
Geological Survey, Menlo Park, Calif.
William R. Powers, III.
Geological Survey Open-file Report, July 1970. 1 p, 8 fig, 3 tab, 2 ref.

Descriptors: *Water resources, *Semiarid climates *California, Groundwater, Surface waters, Rainfall, Runoff, Evaporation, Data collections, Water table, Aquifers, Water yield, Streamflow, Flow rates, Meteorological data, Hydrologic data, Climatic data, Hydrographs.
Identifiers: Mojave Desert region (Calif), *Water inventory.

This is the third annual report prepared by the U.S Geological Survey in cooperation with the Antelope Valley-East Kern Water Agency (AVEK) to assist the agency in its program of basin management. As part of that program, streamflow precipitation, evaporation, and groundwater data are being collected on a continuing basis by the U.S. Geological Survey. These hydrologic data are being analyzed annually. The AVEK area is about 35 miles north of Los Angeles, Calif., in the southwestern part of the Mojave Desert region covering part of the northeastern section of Los Angeles County and part of the southeastern part of Kern County. The AVEK area is in the area of Lancaster, Mojave, and Palmdale. Precipitation evaporation, streamflow, and groundwater levels analyzed from spring 1968 to spring 1969 show that precipitation and runoff were below normal evaporation was about normal, and water levels continued to decline at about the same rate as in the past--about 8 feet per year in the area of maximum decline. (Woodard-USGS)
W71-02455

BIBLIOGRAPHY OF MONTANA WATER RESOURCES AND RELATED PUBLICATIONS.
Montana Water Resources Board, Helena.
For primary bibliographic entry see Field 10.
W71-02469

PRELIMINARY INVENTORY OF THE WATER RESOURCES OF IDAHO.
Idaho Univ., Moscow. Water Resources Research Inst.
For primary bibliographic entry see Field 07C.
W71-02471

DISCUSSION OF 'MECHANICS OF CONDENSER WATER DISCHARGE FROM THERMAL POWER PLANTS' BY D. R. HARLEMAN,
California Inst. of Tech., Pasadena. Dept. of Civil Engineering.
For primary bibliographic entry see Field 05B.
W71-02483

MODELING OF HEATED WATER DISCHARGES,
Hydraulic Research Station, Wallingford (England).
For primary bibliographic entry see Field 05B.
W71-02484

DISCUSSION OF 'MODELING OF HEATED DISCHARGES' BY PETER ACKERS,
Tennessee Valley Authority, Norris. Engineering Lab.
For primary bibliographic entry see Field 05B.
W71-02485

2F. Groundwater

THE ROLE OF UNDERGROUND FLOW IN THE WATER BALANCE OF THE USSR,
State Hydrological Inst., Leningrad (USSR).
For primary bibliographic entry see Field 02A.
W71-02255

EVALUATION OF THE GROUNDWATER BALANCE OF LARGE TERRITORIES,
All-Union Scientific Research Inst. of Hydrogeology and Engineering Geology, Moscow (USSR).
For primary bibliographic entry see Field 02A.
W71-02256

ON THE ROLE OF UNDERGROUND STORAGE IN THE SETTING UP OF THE WATER BALANCE (FRENCH),
For primary bibliographic entry see Field 02A.
W71-02257

HYDROGEOLOGIC DATA FOR THE SOUTHWESTERN COASTAL RIVER BASINS, CONNECTICUT,
Geological Survey, Hartford, Conn.
For primary bibliographic entry see Field 02E.
W71-02259

HYDRODYNAMICS OF FLOW IN POROUS MEDIA,
Technische Universitaet, Dresden (East Germany).
For primary bibliographic entry see Field 04A.
W71-02260

A CONTRIBUTION TO THE SOLUTION OF GROUNDWATER FLOW PROBLEMS BY MEANS OF PASSIVE ELECTRICAL ANALOGUE MODELS BY DISCRETIZATION OF THE TIME VARIABLE,
Technische Universitaet, Dresden (East Germany).
Ludwig Luckner, and Dietmar Peukert.
French resume. In: Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 4 (Subject D), Science Council of Japan, Kyoto, p 423-432, 1969. 10 p, 4 fig, 5 ref.

Descriptors: *Groundwater movement, *Flow, *Analog models, Mathematical studies, Equations, Aquifer characteristics, Storage capacity, Transmissivity, Flow characteristics.

For nonstationary vertical plane and axial rotational symmetric groundwater flow fields having a free surface, the fundamentals of simulation are found on electrically conducting paper, in the electrolytic tank, and in R-networks drainage wells for the drainage of open-work minings. The dependence of the profile transmissibility on the potential in the horizontal plane flow can be simulated by means of R-networks if the time variable is discretional. The profile transmissibility to be simulated can be maintained constant when adopting correction currents. Based on these possibilities the fundamentals of two methods are described where the entire nonlinearity is concentrated in the potentials applied at the time resistors. These methods represent a good base for hybrid calculations. (Woodard-USGS)
W71-02261

TRANSIENT CHARACTERISTICS OF SALT-WATER WEDGE,
Saitama Univ., Urawa (Japan). Dept. of Foundation Engineering.
Sukeyuki Shima.
French summary. In: Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 4 (Subject D), Science Council of Japan, Kyoto, p 433-440, 1969. 8 p, 5 fig, 4 ref.

Descriptors: *Groundwater movement, *Saline water, *Flow characteristics, *Aquifers, Beaches, Mathematical studies, Equations, Theoretical analysis, *Saline water intrusion, Saline water-freshwater interfaces.
Identifiers: *Salt-water wedge, Coastal aquifers.

Transitional characteristics of salt-water wedges in unconfined aquifers are investigated with special consideration to the effects of changes in freshwater depth at coastal line, and deformations of the shape of moving interfaces. Theoretical treatments concerning wedge intrusion, when a barrier is abruptly removed, are made. The results are compared to the experimental data, and a fair agreement between theory and experiment are obtained. (Woodard-USGS)
W71-02262

VELOCITY AND SURFACE SLOPE RELATIONSHIPS IN UNSTEADY LAMINAR FLOW,
Cincinnati Univ., Ohio. Dept. of Civil Engineering.
For primary bibliographic entry see Field 08B.
W71-02263

MATHEMATICAL MODELS OF GROUNDWATER FLOW,
Technische Universitaet, Dresden (East Germany).
Karl-Franz Busch, and Ludwig Luckner.
French resume. In: Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 4 (Subject D), Science Council of Japan, Kyoto, p 401-409, 1969. 9 p, 1 tab. 1 ref.

Descriptors: *Groundwater movement, *Mathematical models, Fluid mechanics, Hydraulic conductivity, Theoretical analysis, Saturated flow, Unsaturated flow, Aquifer characteristics, Soil profiles, Flow, Diffusion, Boundaries (Surface), Velocity, Equations, Density, Gravity, Kinetics.

The mathematical model for all kinetic processes of the law consists of conservation of energy, the law of conservation of matter, validity laws and equations of boundary conditions. The kinetic laws can be derived theoretically as force equilibrium laws (special forms of the law of the conservation of energy) for the saturated and unsaturated filter flow. Thus these previously empiric laws turn to theoretically based fundamental laws so that clear statements can be made as to their limitations of validity. The laws of conservation of mass serve as special forms of the law of conservation of matter for mathematical models of groundwater movement where the following laws can be derived: one law in the interior of the field, one law at the free surface which can be considered as the boundary condition, and one law comprehending all the flow and storage processes. The most important mathematical models of groundwater flow are summarized in a table. (Woodard-USGS)
W71-02264

CONTROL OF SEA WATER LEVEL IN COASTAL POROUS MEDIA BY MEANS OF DOUBLE PUMPING,
Kyoto Univ. (Japan). Dept. of Civil Engineering.
For primary bibliographic entry see Field 02L.
W71-02265

THE STUDY OF COLLECTOR WELLS BY MEANS OF VISCOUS FLOW ANALOGY,
Technical Univ. of Istanbul (Turkey). Dept. of Hydraulics and Water Power.
For primary bibliographic entry see Field 08B.
W71-02266

NON-DARCY FLOW SOLVED BY FINITE ELEMENT ANALYSIS,
Windsor Univ., Ontario. Dept. of Civil Engineering.
For primary bibliographic entry see Field 08B.
W71-02267

THE INTEGRAL DISPLACEMENT OF THE FLUIDS THROUGH NONHOMOGENEOUS POROUS MEDIA,
Academia R.P.R., Bucharest.
For primary bibliographic entry see Field 08B.
W71-02268

WATER MOTION IN EARTH STRUCTURES AT VARYING WATER LEVELS IN A REACH,
Akademiya Nauk SSSR, Novosibirsk.
For primary bibliographic entry see Field 02G.
W71-02269

DEEP WELL DISPOSAL STUDY FOR BALDWIN, ESCAMBIA AND MOBILE COUNTIES, ALABAMA,
Alabama Geological Survey, University.
For primary bibliographic entry see Field 05E.
W71-02428

HYDRAULIC TESTS IN HOLE UA-1 AND WATER INFLOW INTO AN UNDERGROUND CHAMBER, AMCHITKA ISLAND, ALASKA,
Geological Survey, Denver, Colo.
For primary bibliographic entry see Field 04B.
W71-02429

NUMERICAL SOLUTIONS FOR THE RADICAL SUBSURFACE FLOW PROBLEM,
National Center for Atmospheric Research, Boulder, Colo. Atmospheric Science Lab.
For primary bibliographic entry see Field 02G.
W71-02444

THE ROCK AND BONG TECHNIQUES OF MEASURING WATER LEVELS IN WELLS,
Missouri Univ., Rolla. Dept. of Geology and Geophysics.
For primary bibliographic entry see Field 07B.
W71-02445

SOME LIMITATIONS OF SEISMIC REFRACTION METHODS IN GEOHYDROLOGICAL SURVEYS OF DEEP ALLUVIAL BASINS,
Agricultural Research Service, Tucson, Ariz. Southwest Watershed Research Center.
D. E. Wallace.
Groundwater, Vol 8, No 6, p 8-13, November-December 1970. 6 p, 5 fig, 1 tab, 11 ref.

Descriptors: *Hydrogeology, *Seismic studies, *Water table, *Arizona, Alluvium, Exploration, Geology, Mapping, Geophysics, Water levels, Geology, Aquifers, Permeability, Transmissivity, Groundwater movement.
Identifiers: *Groundwater prospecting, Tombstone (Ariz), Walnut Gulch Experimental Watershed, Experimental watersheds.

Seismic methods combined with available well and geologic data were used to define the subsurface hydrologic and geologic conditions of the Walnut Gulch Experimental Watershed, a deep, alluvial basin near Tombstone, Arizona. Seismic determinations revealed depths to the water table ranging from near zero to 475 feet in the central portion of the watershed. The accuracy of predicting the depth to either groundwater or basement was 6 percent, while that for groundwater alone was 10 percent. The great depths of alluvium created the problem of estimating the seismic traverse length necessary to accurately determine the alluvium-basement interface. Increased compaction of alluvium with depth causes additional interpretation difficulties in some areas. Also, water-table eleva-

tion may not always be accurately determined above and close to a higher velocity layer. Gravity or well log information greatly increases the reliability of seismic information. (Knapp-USGS)
W71-02446

GROUNDWATER AVAILABILITY IN FORD COUNTY,
Illinois State Water Survey, Urbana.
James P. Gibb.
Illinois State Water Survey Circular 97, 1970. 66 p, 13 fig, 2 tab, 24 ref, 2 append.

Descriptors: *Groundwater, *Water resources, *Illinois, Geology, Aquifers, Wells, Geologic mapping, Groundwater movement, Water table, Water supply, Water quality, Chemical analysis, Data collections, Aquifer characteristics, Water yield, Specific capacity, Consumptive use.
Identifiers: *Ford County (Ill).

Groundwater in Ford County, Illinois normally can be obtained from one of two primary water-bearing units within the glacial drift or from the underlying bedrock formations. The drift deposits consist of the Wisconsinan, Illinoian, and Kansan age glacial materials underlain by Pennsylvanian, Mississippian, Devonian, and Silurian age bedrock formations. Glacial deposits of Wisconsinan age provide approximately 64 percent of the county's current water supply. An estimated 2.2 million gallons of water are pumped from the aquifers of Ford County each day to satisfy industrial, municipal, domestic, and rural needs. A much larger quantity of water, perhaps as much as 51 million gallons a day, could probably be withdrawn without overdevelopment. Maps and tables indicating the probable maximum depth of wells, water levels, chemical quality, and general groundwater conditions for each water-bearing unit at specific locations are presented to serve as a guide in the development and utilization of the groundwater resources of Ford County. (Woodard-USGS)
W71-02449

GEOLOGY AND GROUNDWATER RESOURCES OF LINN COUNTY, IOWA,
Geological Survey, Iowa City, Iowa.
Robert E. Hansen.
Iowa Geological Survey Water Supply Bulletin No 10, 1970. 66 p, 25 fig, 6 plate, 8 tab, 33 ref.

Descriptors: *Groundwater, *Water resources, *Geology, *Iowa, Aquifers, *Aquifer characteristics, Water yield, Water quality, Chemical analysis, Water supply, Consumptive use, Data collections, Water levels, Water sources, Hydrologic data.
Identifiers: *Linn County (Iowa).

Linn County, in east-central Iowa, covers about 713 square miles and lies in the Western Young Drift section of the Central Lowlands physiographic province. The normal annual rainfall in the county is about 33 inches and the annual mean temperature is about 48 degrees F. The population in 1960 was 136,899, of which 75 percent was urban. Groundwater sources involving the identification and delineation of the water-bearing rock units and an evaluation of the availability, yield, and chemical quality of water contained in these rocks are presented. This information will supply the data necessary to determine alternate sources of groundwater in problem areas and to define the most favorable groundwater sources for future needs. The principal aquifers are alluvium, buried channel deposits, Silurian-Devonian limestones and dolomites, and the Jordan Sandstone. All yield fair-to-good quality water, although the water is hard and locally contains high concentrations of iron. All are capable of yielding as much as 500 gallons or more per minute to wells. (Woodard-USGS)
W71-02450

DIGITAL SIMULATION OF THE OGALLALA AQUIFER IN SHERMAN COUNTY, KANSAS,
Kansas State Geological Survey, Colby.
Thomas J. McClain.
Geological Survey Open-file Report, 1970. 30 p, 10 fig, 3 tab, 11 ref.

Descriptors: *Groundwater, *Water resources, *Kansas, *Computer models, Computer programs, Water supply, Consumptive use, Observation wells, Data collections, Hydrologic data, Water table, Aquifer characteristics, Water yield, Future planning (Projected), Digital computers, Equations, Water levels.
Identifiers: *Ogallala aquifer, *Sherman County (Kan).

An area of 340 square miles was selected for developing a digital computer model of the Ogallala aquifer. The digital model was adapted to simulate inflow, outflow, water levels, recharge, transmissivities, storage coefficients, saturated thickness, and discharge. The model was tested and found to be compatible with actual field conditions during the period 1966 through 1969. It was then programmed to define the effects on water levels of future development (1970 through 1989). With the continued groundwater development and annual pumpage assumed, digital model computations indicate a depletion of the aquifer in the area studies by 19 percent by 1981 and 40 percent by 1990. With no increase in development or annual pumpage from 1970 through 1989, model computations indicate that the aquifer could be depleted by 26 percent. A storage coefficient of 0.15 was used in this study but computations indicate that a slightly larger storage coefficient of 0.16 or 0.17 could have been used. (Woodard-USGS)
W71-02454

WATER-RESOURCES INVENTORY SPRING 1968 TO SPRING 1969--ANTELOPE VALLEY-EAST KERN WATER AGENCY AREA, CALIFORNIA,
Geological Survey, Menlo Park, Calif.
For primary bibliographic entry see Field 02E.
W71-02455

EVALUATION OF RESOURCES OF SHALLOW AQUIFIERS (IN FRENCH),
For primary bibliographic entry see Field 02A.
W71-02467

GROUNDWATER IN MONTANA,
Montana Bureau of Mines and Geology, Butte.
Miller Hansen.
Montana Water Resource Board Inventory Series Report No 16, November 1969. 145 p, 59 fig, 3 tab, 6 ref.

Descriptors: *Groundwater, *Water resources, *Montana, Aquifers, Water yield, Storage, Recharge, Water quality, Geology, Aquifer characteristics, Wells, Precipitation (Atmospheric), Water table, Pumping, Hydrologic data, Springs, Water levels, Domestic water, Irrigation, Specific capacity, River basins, Maps.

Published groundwater reports and other reports containing information required in estimating availability of groundwater in Montana, were reviewed, summarized, and compiled into one publication. The unconsolidated aquifer summaries provide information that includes aquifer area, thickness, specific yield, groundwater in storage, perennial recharge, and water quality in each report area. The unconsolidated aquifers are grouped by drainage basins in this compilation. More than 42,000 wells and 18,000 springs in both the unconsolidated and in the bedrock aquifers are recorded under the provisions of Montana water laws. Springs are of considerable importance in Montana for domestic, stock, municipal, and irrigation water. An important use of springs is shown by the location of fish hatcheries at several springs in the State. The quality of groundwater is generally excellent to good in western Montana, excellent to fair in central Montana, and good to poor in the eastern part of the state. (Woodard-USGS)
W71-02468

BIBLIOGRAPHY OF MONTANA WATER RESOURCES AND RELATED PUBLICATIONS.
Montana Water Resources Board, Helena.
For primary bibliographic entry see Field 10.
W71-02469

PRELIMINARY INVENTORY OF THE WATER RESOURCES OF IDAHO.
Idaho Univ., Moscow. Water Resources Research Inst.
For primary bibliographic entry see Field 07C.
W71-02471

AVERAGE ENTITIES IN KINEMATICS AND THERMODYNAMICS OF POROUS MATERIALS,
Technion - Israel Inst. of Tech., Haifa. Lab. of Soil Science.
Dan Zaslavsky.
Soil Science, Vol 106, No 5, p 358-362, November 1968. 1 fig, 34 equations, 3 ref. P.L. 480.

Descriptors: *Porous media, *Thermodynamics, *Soil physics, *Groundwater movement, *Arid lands, Equations, Mathematical studies, Properties.
Identifiers: *Kinematics, *Continuum mechanics, *Media phases, *Soil-water relationships, Parameters, Fluxes.

Mathematical treatment of porous medium properties allows better utilization of ground-water--the primary water source for arid and semi-arid lands. A porous medium has these characteristics: (a) it consists of many different kinds of phases (homogeneous, heterogeneous, porous), some being fluid, partially fluid, or solid; (b) its different phases are spacially well distributed and (c) it can be treated as a continuum. The source of its heterogeneity may be in particles or portions of different size orders, ranging from molecules to geographic regions. The use of derivatives and integrals in the formulation of general laws for porous media requires the definition of properties which vary as a continuum. This approach has been implicit. This article develops the formulation of general laws systematically and explicitly. Definition of a continuum, averaging the parameters of contents, averaging the fluxes, the two-translated subsystem, average rotation, and the general form of average forces are discussed through 34 equations, in vector, integral, total and partial derivative form. Thermodynamic forces are also considered. (Popkin-Arizona)
W71-02518

LOCATING AND TRACING SEEPAGE WATER IN UNSTABLE SLOPES,
Kentucky Dept. of Highways, Lexington. Div. of Research.
For primary bibliographic entry see Field 04A.
W71-02522

2G. Water in Soils

ROOT EXPLORATION RATE: A NEW CONCEPT IN THE STUDY OF SOIL WATER REMOVAL BY PLANTS (IN FRENCH),
Oregon State Univ., Corvallis. Dept. of Soils.
L. W. De Backer, and L. Boersma.
In: Science du Sol - No 2, Supplement au Bulletin de l'Association Francaise pour l'Edude du Sol, p 3-20, 1968. 18 p, 8 fig, 6 tab, 4 ref. OWRR Project B-001-ORE (4).

Descriptors: *Moisture uptake, *Root zone, Moisture availability, Soil moisture, Soil moisture movement, Transpiration, Water utilization, Oak trees, Fir trees.
Identifiers: Root exploration rate (Plants).

From a plot of cumulative soil water uptakes by plants with depth over a period of time, a curve of the slopes of this cumulative function versus depth is obtained. Such a curve presents a maximum interpreted as being the depth of greatest root activity. From a series of such curves, it is possible to plot the advance of the maximum root activity zone during the soil water depletion cycle. The time rate of change of the maximum root activity depth defines the root exploration rate. Under the same climatic conditions, the root exploration rate of oaks was five times greater than that of douglas firs, whereas the soil water availability of the fir plot was about 2.5 times greater than that of the oak plot. Combining the water availability coefficient and the porosity of the soil with the root exploration rate, it is possible to establish the rate of water used by the plants. (Knapp-USGS)
W71-02203

MUD VOLCANO CLAY, TRINIDAD, WEST INDIES,
Columbia Univ., New York. Dept. of Geology.
For primary bibliographic entry see Field 02J.
W71-02213

HYDRODYNAMICS OF FLOW IN POROUS MEDIA,
Technische Universitaet, Dresden (East Germany).
For primary bibliographic entry see Field 04A.
W71-02260

WATER MOTION IN EARTH STRUCTURES AT VARYING WATER LEVELS IN A REACH,
Akademiya Nauk SSSR, Novosibirsk.
V. G. Pryazhinskaya.
French resume. In: Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 4 (Subject D), Science Council of Japan, Kyoto, p 257-263, 1969. 7 p, 5 fig, 3 ref.

Descriptors: *Unsteady flow, *Water level fluctuations, *Bank storage, *Groundwater movement, *Surface-groundwater relationships, Filtration, Recharge, Water storage, Discharge (Water), Computer programs, Mapping, Mathematical studies.
Identifiers: *Unstable filtration.

Problems of unstable filtration of groundwater may be solved by conformal mapping, using numerical calculations on electronic computers. The problem of unstable filtration caused by water surface fluctuations in the adjoining reservoir, and the physical analogies of groundwater motion due to waves on infiltration near the gently sloping sea coast are examples presented. The potential nonstationary motion of groundwaters with a free surface occurs in the homogeneous material of infinite depth. (Knapp-USGS)
W71-02269

FILTRATION CALCULATIONS OF HORIZONTAL AND VERTICAL DRAINAGES IN NON-UNIFORM STRATIFIED SOILS,
Akademiya Nauk URSR, Kiev.
A. Y. Oleinick.
French resume. In: Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 4 (Subject D), Science Council of Japan, Kyoto, p 239-246, 1969. 8 p, 2 fig, 1 tab, 5 ref.

Descriptors: *Drainage systems, *Soil water movement, Water levels, Mathematical studies, Water wells, Aquifers.
Identifiers: Non-uniform stratified soils.

Methods are given for calculation of flow to horizontal drains and incomplete vertical wells in two-layer and three-layer strata. These methods are the result of the strict solution of water inflow to horizontal drains and vertical wells in stratified soils. On the basis of these solutions practical methods have been worked out to be used for calculating water lowering, the capture of fresh and salt waters, or draining hydrotechnical structures. A formula for determining drain discharge per unit length and the yield of an incomplete well is also presented. (Knapp-USGS)
W71-02270

ANALYTICAL TREATMENT OF TWO-PHASE INFILTRATION,
Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
Richard L. Brustkern, and Hubert J. Morel-Seytoux.
ASCE Proceedings, Journal of the Hydraulics Division, Vol 96, No HY12, Paper 7743, p 2535-2548, December 1970. 14 p, 10 fig, 8 ref, append.

Descriptors: *Unsaturated flow, *Computer programs, *Numerical analysis, *Infiltration, Soil moisture movement, Porous media, Capillary action.
Identifiers: *Multiphase flow.

An approximate analytical treatment for the problem of one-dimensional infiltration into a homogeneous porous medium is presented. Movement of both the air phase and the water phase is considered. The procedure assumes that capillary pressure can be neglected in the saturation equation, whereas it is retained in an integral equation for the unknown total flow. The two equations are solved in a step-wise manner to yield the saturation profile, and the infiltration rate at any time. Infiltration rate curves are obtained for a number of situations involving different boundary or initial conditions or both. Infiltration rate predictions are in good agreement with those predicted by a finite difference solution. This is quite promising in view of the fact that the computer costs are an order of magnitude less than by the finite difference technique. (Knapp-USGS)
W71-02430

HYDROLOGY OF SPRAY-RUNOFF WASTE WATER TREATMENT,
Robert S. Kerr Water Research Center, Ada, Okla.
For primary bibliographic entry see Field 05D.
W71-02437

SOIL CATENA CONCEPT FOR HYDROLOGIC INTERPRETATIONS,
Pennsylvania State Univ., University Park. Dept. of Civil Engineering.
S. L. Chiang, and G. W. Petersen.
Journal of Soil and Water Conservation, Vol 25, No 6, p 225-227, November-December 1970. 3 p, 3 tab, 8 ref.

Descriptors: *Rainfall-runoff relationships, *Soil water movement, *Infiltration, *Soil physical properties, *Soil classifications, Soil groups, Soil investigations, Soil types, Hydrogeology, Surface-groundwater relationships.
Identifiers: Soil catenas, *Runoff-soil water relationships.

Understanding the relationship between soil characteristics and the behavior of runoff water is requisite to improved soil and water conservation. To effectively convey hydrologic soils information from soil scientists to non-soil scientists, an ideal soil catena diagram is proposed. This diagram relates parent material, texture, drainage, depth, and to some extent, the subsurface conditions of the soil. Soils of low runoff potential have high infiltration rates even when thoroughly wetted and consists chiefly of deep, well to excessively drained sands or gravels. Soils having moderate infiltration rates when thoroughly wetted are chiefly moderately deep to deep, moderately well to well-drained, with moderately fine to moderately coarse textures. Soils having slow infiltration rates when thoroughly wetted usually have a layer that impedes downward movement of water, or have moderately fine to fine texture. Soils of high runoff potential have very slow infiltration rates when thoroughly wetted and include clay soils with a high swelling potential, soils with a permanent high water table, soils with a claypan or clay layer at or near the surface, and shallow soils over nearly impervious material. (Knapp-USGS)
W71-02442

NUMERICAL SOLUTIONS FOR THE RADICAL SUBSURFACE FLOW PROBLEM,
National Center for Atmospheric Research, Boulder, Colo. Atmospheric Science Lab.
Ronald L. Drake, and Michael B. Ellingson.
Groundwater, Vol 8, No 6, p 39-47, November-December 1970. 9 p, 6 fig, 2 tab, 7 ref.

Descriptors: *Soil water movement, *Numerical analysis, *Unsteady flow, *Unsaturated flow, *Diffusivity, Mathematical studies, Percolation, Subsurface flow.
Identifiers: *Radial subsurface flow.

Two stable finite difference schemes are presented for the numerical solution of the nonlinear partial differential equation describing the radial flow of soil moisture. The nonlinearity exists because soil moisture diffusivity is a nonconstant function of the nondimensional soil moisture. Numerical solutions are given for 21 different moisture-dependent diffusivities. From these numerical solutions quantitative results are obtained for the following: (1) the boundedness and monotonicity of the moisture distribution; (2) the continuous dependence of the moisture distribution on the system's parameter, namely, the diffusivity; (3) the rate at which the wetting front approaches the steady state solution; (4) the evolution of the moisture front with time and with the formulation of the diffusivity; and (5) the time evolution of the rate of inflow or outflow at the wall of the source or sink. (Knapp-USGS)
W71-02444

BROWN STEPPE SOIL IN THE UPPER PART OF WADI EATEL (NORTHWEST TRIPOLITANIA),
Institute for Soil Research, Belgrade (Yugoslavia).
D. J. Filipovic, and M. Spasojevic.
Soil Science, Vol 106, No 2, p 131-135, August 1968. 4 tab, 4 ref.

Descriptors: *Soil surveys, *Soil physical properties, *Sierozems, *Agriculture, *Brown soils, Irrigation, Porous media, Soil chemical properties, Hydraulic conductivity, Loam, Porosity, Water quality, Arid lands, Cation exchange, Sands, Soil texture, Particle size, Darcys law, Soil density, Field capacity, Wilting point.
Identifiers: *Brown steppe soil, *Wadi Eatel (Northwest Tripolitania), *Libya, *Irrigation potential, Darcys coefficient, Bulk density, Cation exchange capacity.

About 8000 ha. of the Wadi Eatel in Northwest Tripolitania (Libya) is covered by brown steppe soil. The soil is sandy loam and loamy sand, formed on calcareous material consisting of three subvarieties. Sandy loam samples had respectively: porosity, Darcy coefficient, cation exchange capacity, and bulk density ranges of 47.80 to 52.00 volume percent, .00010 to .00045 K cm/sec, 8.76 to 13.83 meq/100g, and 1.39 to 1.43 g/ccm. Loamy sand samples showed porosity, Darcy coefficient, cation exchange capacity, and bulk density ranges of 44.00 to 48.10 volume percent, .00046 to .00640 K cm/sec, 7.35 to 14.00 meq/100g, and 1.37 to 1.46 g/ccm. A water sample taken in the upper part of the wadi showed high salinity (dissolved solids — 1302 ppm), and was suitable for supplemental winter irrigation on brown steppe soils. Chemical soil properties are favorable for agriculture. Mineral fertilizers would make more intensive soil utilization possible. Irrigation could become very useful where it can be provided. Tables present soild texture, chemical and physical properties, and water analyses. (Popkin-Arizona)
W71-02502

SOIL GEOGRAPHY AND FACTORS OF SOIL FORMATION IN AFGHANISTAN,
Wisconsin Univ., Madison. Dept. of Soil Science.
M. Zarif Salem, and Francis D. Hole.
Soil Science, Vol 107, No 4, p 289-295, April 1969. 6 fig, 17 ref.

Descriptors: *Soil formation, *Plant groupings, *Soil-water-plant relationships, *Soil profiles, *Arid lands, Sierozems, Grasslands, Climatic zones, Alluvium, Loam, Sands, Dunes, Deserts, Clays, Geographic regions, On-site observations, Precipitation (Atmospheric), Drainage patterns (Geologic).
Identifiers: *Soil geography, *Pedogenesis, *Phytogeographical provinces, *Afghanistan, Alluvial soil, Humic Gley soil, Low-latitude desert, Asiatic climatic system.

This study reports on field observations of 8 Afghanistan soil profiles, general information on soil geography and pedogenetic factors. Two are alluvial soils (Darweshan silty clay, or Typic Ustifluvent, and Shisham Bagh sandy loam, or Typic Ustifluvent), five are Desert soils (Kabul silt loam, or Mollic Haplargid, Nadi Ali sandy loam, or Typic Haplargid, Bost sandy loam, or Typic Haplargid, Alchin silt loam, or Typic Haplargid, and Abul Khail silt loam, or Typic Haplargid), and one a Humic Gley (Pozay Aishan silty clay, or Cumulic Argiaquoll). About 40 percent of the country is in arid wastelands. The topography consists of lowlands (sand dunes, salty marshes, playas), plains (sand dunes, desert flats, playas, broad river valleys), plateaus and uplands (marshlands and small lakes), and mountain ranges, high mountain ranges and peaks (mountain glaciers). Afghanistan is located in the low-latitude desert and steppe belt of the Asiatic climatic system. Six phytogeographical provinces are correlated with 8 climatic zones, where temperature, dryness index (evaporation/precipitation ratio), precipitation and wind are important. Maps of topography, soil, drainage, climatic types, and phytogeography and representative soil profile section are included. (Popkin-Arizona)
W71-02503

GILGAI IN THE QUATERNARY,
Commonwealth Scientific and Industrial Research Organization, Melbourne (Australia).
E. G. Hallsworth, and G. G. Beckmann.
Soil Science, Vol 107, No 6, p 409-420, June 1969. 1 tab, 2 fig, 36 ref.

Descriptors: *Soil physical properties, *Soil physics, *Quaternary period, *Hydraulic conductivity, *Arid lands, Wetting, Particle size, Plasticity, Paleohydrology, Paleoclimatology, Soil profiles, Soil groups, Geomorphology, Cracking, Geologic formations, Montmorillonite, Drying, Data collections.
Identifiers: *Soil micromorphology, *Gilgai phenomena, *Gilgai classification, *Australia, *Swelling profile, Layering, Paleogeography.

An account is given of data on soil, showing the gilgai phenomena and presenting analyses of factors responsible for the different forms. Attention is given to possible relationships between gilgai and Quaternary history. Gilgai is applied to describe the surface micromorphological phenomena of alternate hummocks and hollows of soils beyond periglacial areas. The phenomena is widespread in Australia. Gilgai forms are classified as normal (round), melon-hole, lattice, linear (wavy), tank, and stony. The surface soil material of the mounds is related to and continuous with the subsoil of the depressions. Gilgai soils are predominantly montmorillonitic. Micromorphology suggests that gilgai soils are sedimentary in origin and show layering. Magnitude and pattern of the gilgai, formed by soil cracks on drying and wetting, are results of swelling profile, size of soil aggregates, wetting cycle, hydraulic conductivity profile and plasticity profile. The gilgai are a clue to paleoclimate, paleohydrology and paleogeography. Analytical data for gilgai in Australia, South Dakota and Katanga are tabulated. Figures of gilgai types and a cross section of a depression are included. (Popkin-Arizona)
W71-02505

EFFECT OF TEMPERATURE AND pH ON SODIUM TRANSLOCATION AND SODIUM EXCHANGE REACTIONS IN BUSH BEANS,
California Univ., Los Angeles.
Arthur Wallace.
Soil Science, Vol 106, No 2, p 144-148, August 1968. 9 tab, 12 ref. NSF Grant No 3683.

Descriptors: *Temperature, *Acidity, *Translocation, *Sodium, *Soil-water-plant relationships, Ammonium salts, Carbon dioxide, Root systems, Beans, Hydrogen ion concentration, Plant physiology, Aeration, Salts, Damages, Cation exchange.
Identifiers: *Bush beans, *Sodium exchange reactions, Milk acid, Plant injury.

Bush beans (Phaselus vulgaris var. Improved Tendergreen) were studied for sodium translocation effects to determine information concerning poor translocation of sodium to shoots. Temperatures up to 70 degrees C for short time periods greatly increased sodium translocation without killing the plants, but new roots were generated. Growing plants in nutrient solutions at 43 degrees C for 14 days injured plants and resulted in increased sodium translocation. Ammonium sulfate solutions at 10 to the minus 3 M resulted in enough acidity to increase sodium translocation to stems. The ammonium ion and CO sub 2 aeration caused sodium exchange or leakage. Milk acid treatments did not severely injure bean plants, but resulted in sodium translocation. Root sodium was not subject to exchange with potassium or calcium but was exchanged in 24 hours by external solution sodium indicating that translocation failure is not due to the sodium being chemically bound. Tables show temperature, ammonium sulfate, treatment, CO sub 2 aeration, acid and base treatment, and salt treatment effects. (Popkin-Arizona)
W71-02506

PROBLEMS OF DETERMINATION OF SOIL DENSITY AND MOISTURE PROPERTIES FROM NATURAL CLODS,
Commonwealth Scientific and Industrial Research Organization, Adelaide (Australia). Div. of Soils.
D. S. McIntyre, and J. Loveday.
Soil Science, Vol 105, No 4, p 232-236, April 1968. 1 tab, 4 fig, 12 ref.

Descriptors: *Soil moisture, *Soil density, *Moisture content, *Soil pressure, *Wetting, Loam, Clays, Sampling.
Identifiers: *Natural clods, *Soil suction, *Bulk density.

This paper compares soil density and moisture measurements made on small clods equilibrated at a known suction with those determined from cores taken 24 to 30 hours after wetting. Specimens were taken on a range of soils, from loamy sands to cracking clays. Bulk density and moisture properties depended on the rate of wetting of the air-dry clods. Rapid wetting decreases the bulk density of clayey soils and increases the moisture retained throughout the suction range 50 to 600 cm. Recommended sampling includes use of large samples and sampling under moist conditions. Large volume clods are preferred if clods must be sampled. Wetting of clods should be carried out slowly beginning at suctions greater than 30 cm water. Figures are presented of the difference between 100 cm moisture percentages of clods at various wetting rates, bulk density versus wetting rates, core bulk density and moisture versus wetting rate, and extended time of measurement after wetting. (Popkin-Arizona)
W71-02507

DETERMINING WATER CONTENT OF DIFFERENT SOILS BY THE NEUTRON METHOD,
Agricultural Research Service, Riverside, Calif. Soil and Water Conservation Research Div.
R. E. Luebs, M. J. Brown, and A. E. Laag.
Soil Science, Vol 106, No 3, p 207-212, September 1968. 2 tab, 4 fig, 8 ref.

Descriptors: *Soil moisture meters, *Soil moisture, *Bulk density, *Instrumentation, *Calibrations, Soil physics, Moisture content, Nuclear meters, Depth, Volumetric analysis, Measurement, Soil types.
Identifiers: *Neutron method, *Neutron count rate, *Soil-water relationships.

Advantages which account for wide acceptance of the neutron method for determining soil water content include greater precision, rapidity of measurements, large volume measured and full range of soil water. Count rate and soil water content below the 30-cm depth differed for several soils. Observed maximum difference was equivalent to 4.4 per cent water by volume; curve slopes were similar for investigated soils. Higher count rates were associated with higher bulk density. The most accurate determinations by the neutron method require calibration of bulk density changes. A high linear correlation between count rate and soil water content was obtained for the 0- to 15- cm layer. Repeated determinations of soil water content in the undisturbed 0- to 15-cm layer can be obtained by calibrating for the particular soil and controlling depth of measurement. Tables show percentage of count rate variation with soil water content and count rate determined from calculated regression on volumetric water content. Figures show neutron calibration curves for two depth ranges, and effect of bulk density on counting rate and soil water content. (Popkin-Arizona)
W71-02515

INFLUENCE OF SOIL TEMPERATURE, IRRIGATION AND AERATION ON HEMICYCLIOPHORA ARENARIA,
California Univ., Riverside.
For primary bibliographic entry see Field 02I.
W71-02517

AVERAGE ENTITIES IN KINEMATICS AND THERMODYNAMICS OF POROUS MATERIALS,
Technion - Israel Inst. of Tech., Haifa. Lab. of Soil Science.
For primary bibliographic entry see Field 02F.
W71-02518

A STUDY OF THE HAMRA SOIL ASSOCIATION OF ISRAEL,
Technion - Israel Inst. of Tech., Haifa. Dept. of Agricultural Engineering.
D. Karmeli, and I. Ravina.
Soil Science, Vol 105, No 4, p 209-215, April 1968. 1 tab, 5 fig, 6 ref.

Descriptors: *Soil chemistry, *Soil physics, *Aeolian soils, *Sands, *Clays, Dunes, Cation exchange, Soil properties, X-ray analysis, Soil mechanics, Potassium, Loam, Fine-textured soils, Expansive soils, Electrophoresis.
Identifiers: *Israel, *Hamra soil association, *Cation-exchange capacity (CEC), *Soil-water relationships, Fractions, Electrophoretic mobility.

Hamra soils of Israel were found to consist of two main fractions: sand and clay. The clay--of eolian origin--is added to dune sands to form various soil types. Clay fraction properties are identical, irrespective of content and location. Cation exchange capacity (CEC), internal surface area, free swell properties, electrophoretic mobility, X-ray diffraction analyses, total potassium, chemical and mechanical analyses, and composition of the exchangeable cation complex are discussed. The table of results relates sand, sandy loam, sandy clay loam, sandy Nazaz, grey Nazaz, and black Nazaz to

14 chemical and physical properties. Figures of CEC as a fraction of fine content, frequency distribution of electrophoretic mobilities, X-ray diffractograms, and mechanical analyses are presented. (Popkin-Arizona)
W71-02519

SOIL FERTILITY UNDER CONTINUOUS CULTIVATION IN NORTHERN NIGERIA. I. THE ROLE OF ORGANIC MANURES,
For primary bibliographic entry see Field 05C.
W71-02690

2H. Lakes

BOTTOM STABILITY AND SEDIMENTARY PROCESSES AT LITTLE LAKE HARBOR, LAKE SUPERIOR,
United States Lake Survey, Detroit, Mich.
James H. Saylor, and Sam B. Upchurch.
Available from NTIS as AD-712 300, $3.00 in paper copy, $0.95 in microfiche. Research Report No 2-1, August 1970. 60 p, 38 fig, 1 tab, 21 ref.
Identifiers: *Sedimentation, Dissemination, *Harbors, Construction, *Marine engineering, Great Lakes, Mass transfer, Stability, Breakwaters, Sand, Gravel, Maintenance, Shallow water, Lake Superior, Littoral drift, *Harbor bottom stability, *Lacustrine environment, Shore protection.

The report discusses the relationship of littoral drift to sediment texture and fluctuations in offshore and strandline topography at Little Lake in southeastern Lake Superior. Offshore bars and troughs oscillate about a mean position, depending on the direction and intensity of wave attack. In contrast to the offshore bars and troughs, shallow-water topographic features migrate normal to and along shore with changes in lake level and wave attack. Sediment consists of two distinct populations: pebble-cobble and sand. The pebble-cobble population is relatively immobile and serves as an armor for the beach and nearshore. The sand population is highly mobile and its distribution reveals the effect of the harbor breakwaters on littoral drift. Littoral drift causes harbor maintenance problems, including shoaling in the harbor mouth and beach deterioration adjacent to the breakwaters. A primary cause of the shoaling is entrapment of a portion of the sand fraction bypassing the harbor structures by circulation patterns induced by harbor design.
W71-02293

A HYDROLOGICAL APPROACH TO CONTROL ACID MINE POLLUTION FOR LAKE HOPE,
Ohio Univ., Athens. Dept. of Geology.
For primary bibliographic entry see Field 05G.
W71-02427

LAKE STRATIFICATION CAUSED BY RUNOFF FROM STREET DEICING,
Wisconsin Univ., Milwaukee. Center for Great Lakes Studies.
For primary bibliographic entry see Field 05B.
W71-02441

GENERAL SCHEME FOR CALCULATING THE WATER BALANCE OF CLOSED INLAND SEAS AND LAKES BY THE METHOD OF STATISTICAL MODELLING,
Georgian Power Research Inst., Tiflis (USSR).
G. G. Svanidze, and I. B. Khomeriki.
In: Symposium on World Water Balance, Vol 2, International Association of Scientific Hydrology Publication No 93, p 289-294, July 1970. 6 p, 2 fig, 1 tab, 15 ref.

Descriptors: *Water balance, *Statistical models, *Lakes, Equations, Reviews, Hydrologic cycle, Synoptic analysis, Hydrologic budget, Meteorology, Precipitation (Atmospheric), Runoff, Evaporation, Water storage, International Hydrological Decade.
Identifiers: *USSR, *Closed inland seas.

In arid regions, where evaporation from the water surface exceeds rainfall, there are, in closed basins, bodies of water without outflow. To such bodies of water in the USSR belong the Caspian and Aral seas, the Balkhash and Issyk-Kul lakes and a number of lesser lakes. The variability of water balance of such water bodies entails variations of water level which affect various branches of the economy (navigation, fishing, mining, agricultural utilization of coastal lands, resort economy, etc). In this report pertinent literature is reviewed from which a method is applied to a statistical model for water balance computations on a digital computer. (Woodard-USGS)
W71-02461

STORAGE IN THE WATER BALANCE OF THE LAKE ONTARIO BASIN,
Department of Energy, Mines and Resources, Cornwall (Ontario). Inland Waters Branch.
D. F. Witherspoon.
In: Symposium on World Water Balance, Vol 2, International Association of Scientific Hydrology Publication No 93, p 283-288, July 1970. 6 p, 2 fig, 4 ref.

Descriptors: *Water balance, *Water storage, *Lake Ontario, *Basins, Hydrologic cycle, Model studies, Equations, Meteorology, Synoptic analysis, Precipitation (Atmospheric), Evaporation, Runoff, Streamflow, Solar radiation, Soil moisture, Soil water movement, Water storage, Groundwater, Surface waters, Vegetation, International Hydrological Decade.

Using a hydrologic model based on the water balance, the annual run of storage and its extremes are studied to determine the significance of this factor in the balance of a large land basin of 27,100 square miles which contributes to the local inflow of Lake Ontario. Estimates obtained are reasonable when compared with values estimated from the physical and hydrologic characteristics of the basin. These estimates demonstrate the relative importance of storage to the month by month hydrology of the basin. The storage on the basin is approximately equivalent in volume to that available within the range of stage of Lake Ontario allowable by international agreement between Canada and the United States. (Woodard-USGS)
W71-02462

PHOSPHATE EXCHANGE WITH SEDIMENTS: ITS ROLE IN THE PRODUCTIVITY OF SURFACE WATERS,
Harvard Univ., Cambridge, Mass.
W. Stumm, and J. O. Leckie.
Fifth International Water Pollution Research Conference, San Francisco, July 26-August 2, 1970. Preprint. 16 p, 11 fig, 36 ref.

Descriptors: *Phosphates, *Sediments, *Lakes, Primary productivity, Sediment-water interfaces, Oxygenation, Iron, Aluminum, Calcium, Dredging, Solubility, Kinetics.
Identifiers: Redox potential, Lake Constance, Lake Zurich, Lake Norrviken, Bering Sea.

The availability of phosphorus to algae present in surface waters is a composite function of the supply of total phosphorus in the water basin, release of phosphorus from sediments, regeneration from biota and detritus, and transport processes. The release of phosphates from sediments to epilimnion depends primarily on their diffusion through the interstitial water. For an undisturbed sediment-water interface a maximum phosphorus transfer of 0.000009 mole/ sq meter per day may be estimated. In many cases reactions with iron, aluminum, and calcium immobilize considerable quantities of phosphorus in insoluble form. Various solution parameters induce crystal growth of apatite, the process particularly enhanced in the presence of fluorite. The removal of sediments by dredging may release a large supply of nutrients into water, cause disturbance between benthos and plankton, and lower the buffer capacity of the lake and its resistance to external changes. (Wilde-Wisconsin)
W71-02520

PHOSPHORUS, NITROGEN, AND ALGAE IN LAKE WASHINGTON AFTER DIVERSION OF SEWAGE,
Washington Univ., Seattle. Dept. of Zoology.
For primary bibliographic entry see Field 05C.
W71-02681

2I. Water in Plants

ROOT EXPLORATION RATE: A NEW CONCEPT IN THE STUDY OF SOIL WATER REMOVAL BY PLANTS (IN FRENCH),
Oregon State Univ., Corvallis. Dept. of Soils.
For primary bibliographic entry see Field 02G.
W71-02203

ANALYSIS OF THE DUAL ACTION OF WHITE LIGHT ON GERMINATION OF ATRIPLEX DIMORPHOSTEGIA (CHENOPODIACEAE),
Hebrew Univ., Jerusalem (Israel). Dept. of Botany.
D. Koller.
USDA Grant FG-Is-115. Israel Journal of Botany, Vol 19, No 2, p 499-516, 1970. 6 fig, 11 tab, 12 ref.

Descriptors: *Germination, *Irradiation, *Temperature, *Moisture stress, *Soil-water-plant relationships, Light, Metabolism, Plant growth substances, Mode of action, Physiological ecology, Environmental effects, Laboratory tests, Xerophytes, Photoactivation, Photoperiodism, Inhibition, Varieties, Energy transfer, Plant physiology, Seeds, Infrared radiation, Dispersion.
Identifiers: *Seedlings, *Phytochromes, *Temperature effects, Israel, Negev Desert.

Atriplex dimorphostegia is a Negev Desert plant with 'humped' and 'flat' seed dispersal unit varieties. A percentage of the seeds germinate in the dark at an optimal temperature of 10 deg C. The non-germinating fraction can be induced to germinate by short irradiation with white light. Continuous irradiation is not only ineffective but also inhibits the dark-germination fraction. With photoperiodic irradiation, increasing light/dark ratios resulted in decreasing germination percentages. Germination was promoted by light in the red and inhibited by the far red, indicating that irradiation effects are mediated by phytochromes. The promotive effect of short irradiation is prevented if preceded or followed by long irradiation. Seeds pretreated in darkness at supra-optimal temperature or subjected to water stress were strongly stimulated by short irradiation. Both treatments lessened the inhibitory effects of long irradiation. It is thought that high temperature not only causes promotive phytochrome formation but also interrupts some metabolic pathway resulting in partial inhibition of the phytochrome system. Since they produce synergistic effects on germination, water-stress probably acts to mask the metabolic interruption caused by supra-optimal temperatures. In all cases the 'humped' seeds were more susceptible to inhibitory treatments and less susceptible to promotive treatments. (Casey-Arizona)
W71-02500

SOIL GEOGRAPHY AND FACTORS OF SOIL FORMATION IN AFGHANISTAN,
Wisconsin Univ., Madison. Dept. of Soil Science.
For primary bibliographic entry see Field 02G.
W71-02503

THE CATIONS OF THE COTTON PLANT IN SODIUM SUBSTITUTED POTASSIUM DEFICIENCY,
Texas Agricultural Experiment Station, College Station.
J. V. Amin, and H. E. Joham.
Soil Science, Vol 105, No 4, p 248-254, April 1968. 4 tab, 10 ref.

Descriptors: *Cotton, *Potassium, *Sodium, *Cation exchange, *Soil-plant-water relationships, Solubility, Calcium, Leaves, Plant tissues, Root systems, Nutrient requirements, Proteins, Crop response.
Identifiers: *Potassium deficiency, *Sodium substitution, *Synergistic action, Stems.

Cotton plant cations were studied under conditions of adequate, partially-substituted (Na for K), and deficient potassium nutrition by dividing cations into alcohol soluble and insoluble fractions. The solubility order was: K greater than Na greater than Ca. Potassium deficiency increased the insoluble K/soluble K ratio of the leaves. Increased potassium mobility, increased K absorption and change in K phase distribution in the presence of Na are involved in Na substitution for K in cotton plant nutrition. Substrate Na addition increased Ca in both soluble and insoluble phases. In the range of K substitution, constancy of cations is maintained by synergistic action between Na and other plant cations, including K. Tables show total and percent soluble K, Na, Ca, and protein content as influenced by various K and Na treatments with time. (Popkin-Arizona)
W71-02504

EFFECT OF TEMPERATURE AND pH ON SODIUM TRANSLOCATION AND SODIUM EXCHANGE REACTIONS IN BUSH BEANS,
California Univ., Los Angeles.
For primary bibliographic entry see Field 02G.
W71-02506

ATMOSPHERIC-AND SOIL-INDUCED WATER STRESSES IN PLANTS AND THEIR EFFECTS ON TRANSPIRATION AND PHOTOSYNTHESIS,
Agricultural Research Service, Phoenix, Ariz. Water Conservation Lab.
For primary bibliographic entry see Field 02D.
W71-02508

DROUGHT RESISTANCE OF CYPRESS AND THUYA BRANCHLETS,
Hebrew Univ., Jerusalem (Israel). Dept. of Plant Physiology.
H. R. Oppenheimer.
Israel Journal of Botany, Vol 19, No 2, p 418-428, 1970. 5 fig, 2 tab, 13 ref.

Descriptors: *Plant morphology, *Transpiration, *Xerophytes, *Coniferous trees, *Drought resistance, Stomata, Moisture stress, Leaves, Plant physiology, Plant groupings, Plant tissues, Vascular tissues, Mode of action, Environmental effects, Laboratory tests, Epidermis, Saturation, Water loss, Water conservation, Regulated flow, Physiological ecology, Drought tolerance, Dehydration, Moisture deficit.
Identifiers: *Cypress trees, *Leaf scales, *Water saturation deficits, *Ramilli, *Hydrophobic properties.

Isolated branchlets (ramilli) of 3 xerophytic Cupressaceae species, Cupressus sempervirens, C. glabra and Thuja orientalis, were investigated to determine their absolute and relative drought resistance capabilities. Leaf tissue morphology studies showed that all had imbricate scales, cutin layers overlaying the epidermis and infrequent stomata. Thuja had relatively less imbrication, spongier scale inner structure, thinner cutin, more Ca oxalate and more frequent stomata on unprotected leaf areas. Two aspects never before seen in the cypresses were stomatal concentrations in the protected grooves between the scales and presence of cutinous papillae. Transpiration, calculated as losses of initial weight/hr, was low and extremely variable in all 3 species. During desiccation, vital staining studies indicated inner tissue death in all species occurred only when water losses reached 50% of water content at saturation (WSD) while primary meristems, bundle elements and epidermis were even more resistant, demonstrating a high drought tolerance. Of the 3, Thuja proved the most drought tolerant, probably because of better stomatal regulation and a more efficient cuticle. Stomatal arrangements indicate a 'trickling' type of transpiration with positive and zero phases. The physiological behavior of these species appears to correlate well with their geographical and ecological distributions. (Casey-Arizona)
W71-02509

THE EFFECT OF WATER STRESS ON THE POLYSOME POPULATION AND THE ABILITY TO INCORPORATE AMINO ACIDS IN MAIZE ROOT TIPS,
Hebrew Univ., Jerusalem (Israel). Dept. of Botany.
I. Nir, Alexandra Poljakoff-Mayber, and S. Klein.
Israel Journal of Botany, Vol 19, No 2, p 451-462, 1970. 2 fig, 5 tab, 19 ref.

Descriptors: *Corn (Field), *Biochemistry, *Amino acids, *Moisture stress, *Root systems, Electron microscopy, Sedimentation rates, Chemical properties, Mode of action, Plant physiology, Radiochemical analysis, Proteins, Laboratory tests, Soil-water-plant relationships, Metabolism, Chemical reactions, Synthesis, Separation techniques, Dehydration, Hydration, Physiocochemical properties, Plant tissues, Cytological studies, Genetics, Chromosomes, Damages, Absorption.
Identifiers: *Polysomes, *Seedlings, *DNA, *Messenger RNA, Incorporation, Ribosomes.

Relatively mild plant water stresses affect cell nuclei by inducing chromatin aggregation and polysome disappearance. Determinations of ribosome structure and amino acid uptake and incorporation were made on water stressed root tip cells. Sedimentation analyses of ribosome isolates showed that polysome fractions decreased to 8% in stressed tips relative to controls. These results were supported by electron-micrographs in which stressed root cells had no polysomes. Carbon-14 labelled amino acid uptake and incorporation into trichloroacetic acid was severely reduced in both water stressed intact seedlings and root tips. On the basis of these findings, a possible hypothesis of the underlying effects of water stress on root tip cell function is advanced: cellular dehydration causes nuclear DNA condensation, thereby decreasing m RNA synthesis. The extent of both phenomena is directly proportional to degree of water loss. Decreasing m RNA results in decreasing protoplasmic polysome populations thus reducing protein formation and producing various drought symptoms. Recovery on rehydration is dependent on the extent of damage during stress. (Casey-Arizona)
W71-02512

INTRASPECIFIC DIFFERENCES IN TEMPERATURE-INDUCED RESPIRATORY ACCLIMATION OF DESERT SALTBUSH,
California Univ., Riverside. Dept. of Agronomy.
For primary bibliographic entry see Field 02D.
W71-02514

TRITIUM COLLECTION AND EXTRACTION TECHNIQUES FOR PLANT-WATER RELATIONSHIP STUDIES,
Texas A and M Univ., College Station. Dept. of Range Science.
For primary bibliographic entry see Field 02D.
W71-02516

INFLUENCE OF SOIL TEMPERATURE, IRRIGATION AND AERATION ON HEMICYCLIOPHORA ARENARIA,
California Univ., Riverside.
S. D. Van Gundy, F. D. McElroy, A. F. Cooper, and L. H. Stolzy.
Soil Science, Vol 106, No 4, p 270-274, October 1968. 2 tab, 3 fig, 7 ref. NSF Grant GB-2394.

Descriptors: *Soil temperature, *Irrigation effects, *Aeration, *Nematodes, *Pest control, Citrus fruits, Vegetable crops, Soil-water-plant relationships, Arid lands, California, Sampling, Depth, Reproduction, Life cycles, On-site tests, Greenhouses, Environmental effects, Animal populations, Oxygen, Drying, Rates of application, Diffusion.
Identifiers: *Sheath nematode, *Soil suction, Coachella Valley (California), Imperial Valley (California).

The sheath nematode, Hemicycliophora arenaria Raski, is a relatively new nematode pest to California citrus. It is a native species found on an indigenous plant common in sandy washes and stream beds in the Coachella and Imperial Valleys--cheese bush. It parasitizes vegetable crops in greenhouse experiments, and under optimum conditions of 30 to 32.4 degrees C. and sandy soils, can produce large populations in 3 months. Increased frequency and amount of water application in field and greenhouse tests reduced population numbers of the nematode irrespective of soil temperatures. Oxygen diffusion rate measurements demonstrated that a drying period of 7 days between irrigations was required before there was relatively high and uniform oxygen distribution throughout the top 24 inches of soil. The interval of time between short cycle irrigations did not allow sufficient oxygen diffusion to the lower depths for growth of citrus roots and nematode reproduction. At shallow depths, the frequency interruption of nematode life cycle with 3-day irrigations had some influence on total nematode reproduction. Tables show nematode populations taken at monthly intervals in field soil, and effect of temperature and soil suction on nematode reproduction. Figures of monthly population density and days between irrigation, oxygen diffusion rates and relationship to irrigation frequency are included. (Popkin-Arizona)
W71-02517

FUNCTION AND GROSS MORPHOLOGY IN FISH,
National Science Foundation, Washington, D.C. Special Foreign Currency Science Information Program.
Yu. G. Alecv.
Available from NTIS as TT-67-51391, $3.00 in paper copy, $0.95 in microfiche. Funnktsional'nye Osnovy Vneshnego Stroyen'ya Ryby. Israel Program for Scientific Translations, Jerusalem, 1969. 267 p.
Identifiers: *Fishes, *Morphology (Biology), *Physiology, Fishes, Sense organs, Adaptation (Physiology), Gravity, Motor reactions, Embryology, Nutrition, USSR, Ontogeny, Phylogeny.

The book represents a comprehensive approach in reviewing factors determining the outer organization of fish and deals also with the basic features involved with the dynamics of this organization in the course of ontogeny and phylogeny; the author analyzes the adaptations connected with the animal's movements, its disguise and protection, its catching of food and the provision of the normal function of the animal's sense organ receptors. Special attention is devoted to the review of adaptations associated with movements of the animal owing to the fact that the latter mostly display a most effective influence upon the exterior structure of fish; it is worth mentioning that these factors are examined insufficiently. The greater part of the author's original investigations is devoted to the study of these very complex adaptations. The study also covers adaptations connected with the animal's disguise. The significance of the latter phenomena has not been given adequate elucida-

tion and has not been viewed as factors determining the exterior structure of fish.
W71-02617

2J. Erosion and Sedimentation

SEDIMENT MEASUREMENT TECHNIQUES: RESERVOIR DEPOSITS,

ASCE Proceedings, Journal of the Hydraulics Division, Vito A. Vanoni, Chairman, Task Comm., Vol 96, No HY12, Paper 7781, p 2417-2446, December 1970. 30 p, 25 fig, 1 tab, 19 ref.

Descriptors: *Sedimentology, *Surveys, *Measurement, *Sampling, *Instrumentation, Sediment transport, Data collections, Sediments, Sounding, Acoustics, Nuclear meters, Reservoir silting.
Identifiers: *Sedimentation manual (ASCE).

A chapter on reservoir deposits was written for the ASCE Sedimentation Manual. Reservoir sediment surveys are defined. Guidelines are listed concerning how frequently the surveys should be run. Field equipment is described including sonic sounders; distance measuring apparatus, and auxiliary equipment. Piston core, gravity type, gamma probe, and other types of sediment deposit samplers are illustrated and described. Contour and range methods of reservoir sediment surveys are explained. Several methods of reservoir capacity computations are presented mathematically and graphically. (Knapp-USGS)
W71-02205

MOTION OF SINGLE PARTICLES IN ALLUVIAL CHANNELS,
Geological Survey, Fort Collins, Colo.
Neil S. Grigg.
ASCE Proceedings, Journal of the Hydraulics Division, Vol 96, No HY12, Paper 7770, p 2501-2518, December 1970. 18 p, 12 fig, 4 tab, 8 ref, append.

Descriptors: *Sediment transport, *Tracking techniques, *Alluvial channels, *Hydraulic models, Radioactivity techniques, Tracers, Stochastic processes, Dispersion, Erosion, Sedimentation.
Identifiers: Single-particle tracking.

Movements of single sand-size radioactive particles were followed in a laboratory alluvial channel. Two sizes of bed material were used with experimental conditions limited to the ripple and dune bed forms of the lower flow regime. The frequency distribution of the particle step lengths was represented very well by the gamma distribution, and the frequency distribution of the particle rest periods was represented adequately by the exponential distribution. The mean step lengths related well to the stream power of the flow. The mean rest period related well to the celerity of the bed forms. A one-dimensional stochastic model for sediment dispersion predicted the mean distance traveled by the tracer particles but did not predict the rate of spreading of the tracer concentration distribution. (Knapp-USGS)
W71-02208

SEDIMENTS AND SEDIMENTARY PROCESSES OF EASTERN MISSISSIPPI CONE, GULF OF MEXICO,
Florida State Univ., Tallahassee. Dept. of Geology and Florida State Univ., Tallahassee. Dept. of Oceanography.
Ter-Chien Huang, and H. G. Goodell.
American Association of Petroleum Geologists Bulletin, Vol 54, No 11, p 2070-2100, November 1970. 31 p, 11 fig, 5 tab, 15 ref.

Descriptors: *Sedimentation, *Gulf of Mexico, *Mississippi River, *Deltas, Sedimentary structures, Water chemistry, Geochemistry, Sediments, Suspended load, Bed load, Instrumentation, Surveys, Sands, Silts, Mud, Carbonate rocks, Geophysics, Profiles, Sounding, Sediment transport, Turbidity currents, Deposition (Sediments).
Identifiers: *Mississippi Delta, Mississippi cone.

The upper 6-7 m of sediment of the eastern Mississippi cone consists of gray silt and silty clay intercalated with a few layers of fine sand, topped by a 20-50-cm layer of yellowish-brown foraminiferal clay. Dating shows that the lower silty layers, which are the deposits of latest low sea-level stand, were deposited more rapidly than the upper foraminiferal clay. Sedimentation rates, which depend primarily on the rate of the detrital influx and sea-level change, average about 30 cm/1,000 years. The primary mechanisms of sediment transport are differential pelagic settling and low-flow-regime bottom currents, with many mass movements by sliding or slumping. Most of the structures associated with coarser materials are similar to structures formed by traction transport or by ripple migration in shallow water. Diagenetic solution of carbonate, is related to the degradation of organic matter. Solution is partly responsible for the abrupt decrease of carbonate downward, rearrangement of clay particles into secondary thin laminae, and the shortening of the distance between silt and sand layers. (Knapp-USGS)
W71-02209

GROWTH PATTERNS OF DEEP-SEA FANS,
Scripps Institution of Oceanography, San Diego, Calif. Marine Physical Lab.
For primary bibliographic entry see Field 02L.
W71-02210

EFFECT OF DIAPIRISM ON SEDIMENTATION IN GULF OF MEXICO,
Naval Oceanographic Office, Washington, D.C. Oceanography and Geophysics Branch.
For primary bibliographic entry see Field 02L.
W71-02212

MUD VOLCANO CLAY, TRINIDAD, WEST INDIES,
Columbia Univ., New York. Dept. of Geology.
Paul F. Kerr, Isabella M. Drew, and Darlene S. Richardson.
American Association of Petroleum Geologists Bulletin, Vol 54, No 11, p 2101-2110, November 1970. 10 p, 7 fig, 3 tab, 29 ref.

Descriptors: *Sediment transport, *Sedimentary structures, *Structural geology, *Clays, *Quick clays, Sedimentation, Clay minerals, Mud, Volcanoes, Flow, Mudflows.
Identifiers: *Mud volcanoes, *Trinidad (W.I.), *Thixotropic clays.

Clay-mineral samples from two mud volcanoes on the island of Trinidad were compared with clay samples from the lower Cruse and Nariva Formations, through which the throats of the mud volcanoes are believed to have penetrated. The clay minerals are mixed-layer illite-montmorillonite and kaolinite. In the formation samples, illite is the larger part of the mixed-layer clay. Montmorillonite is preponderant in the clay from the mud volcanoes. All the clay samples examined, when water saturated, become thixotropic with the capacity to flow as a fluid. Thixotropic clay saturated with water becomes a highly mobile fluid with great transporting power. Where such a mobile mass accumulates along a partly broken anticlinal structure, any release of pressure will occur upward. A gas pocket, tectonic squeeze, or both will provide pressure to maintain upward motion. In this way the clay is extruded to form a mud volcano. Although moving vertically and supported by gas and tectonic pressure, the clay flowage has characteristics comparable to horizontal clay movement in landslides, in which motion is maintained by gravity. (Knapp-USGS)
W71-02213

A COMPUTER PROGRAM FOR THE CALCULATION OF HYDROMETER SIZE ANALYSIS,
University Coll. of North Wales, Bangor. Dept. of Physical Oceanography.
For primary bibliographic entry see Field 07C.
W71-02215

DISTRIBUTION AND TRANSPORTATION OF SUSPENDED SEDIMENT IN UPPER CHESAPEAKE BAY,
Johns Hopkins Univ., Baltimore, Md. Chesapeake Bay Inst.
For primary bibliographic entry see Field 02L.
W71-02258

URBAN SOIL EROSION AND SEDIMENT CONTROL,
National Association of Counties Research Foundation, Washington, D.C.
For primary bibliographic entry see Field 04D.
W71-02276

BOTTOM STABILITY AND SEDIMENTARY PROCESSES AT LITTLE LAKE HARBOR, LAKE SUPERIOR,
United States Lake Survey, Detroit, Mich.
For primary bibliographic entry see Field 02H.
W71-02293

MECHANICS OF DEBRIS AVALANCHING IN SHALLOW TILL SOILS OF SOUTHEAST ALASKA,
Forest Service (USDA), Juneau, Alaska. Pacific Northwest Forest and Range Experiment Station.
Douglas N. Swanston.
USDA Forest Service Research Paper PNW-103, 1970. 17 p, 8 fig.

Descriptors: *Debris avalanches, *Landslides, *Mass wasting, *Glacial soils, *Slope stability, Soil erosion, Engineering geology, Soil engineering, Alaska, Clear-cutting.
Identifiers: Southeast Alaska, Soil creep.

Three areas with recent debris avalanches in a shallow, permeable till soil common to southeast Alaska were instrumented and analyzed using established methods of soil mechanics. These studies indicated that a combination of complete saturation during periods of excessive rainfall, naturally unstable slopes (S34 deg.), and the loss of the anchoring effect of tree roots in an otherwise cohesionless soil were the principal causes of the debris avalanching. Areas of general slope instability in a watershed can be located by constructing an isosinal contour map. The critical contour in the study area was 0.6, the sine of 37 deg.
W71-02306

PROCEEDINGS OF THE NATIONAL CONFERENCE ON SEDIMENT CONTROL.
Dept. of Housing and Urban Development, Washington, D.C. Office of Metropolitan Planning and Development.
For primary bibliographic entry see Field 04D.
W71-02425

THE DISTRIBUTION OF Pb, Ag, Sn, Tl, AND Zn IN SEDIMENTS ON ACTIVE OCEANIC RIDGES,
Miami Univ., Fla. Inst. of Marine and Atmospheric Sciences.
For primary bibliographic entry see Field 02K.
W71-02436

POTAMOLOGY DATA COLLECTION ON LOWER MISSISSIPPI RIVER,
Army Engineer District, Vicksburg, Miss. River Stabilization Branch.
For primary bibliographic entry see Field 02E.
W71-02438

STREAM SEDIMENT: AN ENVIRONMENTAL PROBLEM,
Geological Survey, Fort Collins, Colo.
For primary bibliographic entry see Field 04C.
W71-02443

PHOSPHATE EXCHANGE WITH SEDIMENTS: ITS ROLE IN THE PRODUCTIVITY OF SURFACE WATERS,
Harvard Univ., Cambridge, Mass.
For primary bibliographic entry see Field 02H.
W71-02520

2K. Chemical Processes

ELECTROLYTIC CONDUCTANCE AND THE CONDUCTANCES OF THE HALOGEN ACIDS IN WATER,
National Bureau of Standards, Washington, D.C. Inst. for Basic Standards.
For primary bibliographic entry see Field 01B.
W71-02218

WATER GEOCHEMISTRY, HOG CREEK BASIN, CENTRAL TEXAS,
Baylor Univ., Waco, Tex. Dept. of Geology.
For primary bibliographic entry see Field 05A.
W71-02219

TRITIUM IN STREAMS IN THE UNITED STATES, 1961-1968,
Geological Survey, Wash., D.C.; Weather Bureau, Silver Spring, Md. Office of Hydrology; and Massachusetts Univ., Amherst. Coll. of Agriculture.
For primary bibliographic entry see Field 05B.
W71-02434

THE DISTRIBUTION OF Pb, Ag, Sn, Tl, AND Zn IN SEDIMENTS ON ACTIVE OCEANIC RIDGES,
Miami Univ., Fla. Inst. of Marine and Atmospheric Sciences.
Arthur Horowitz.
Marine Geology, Vol 9, No 4, p 241-259, November 1970. 19 p, 5 fig, 7 tab, 30 ref.

Descriptors: *Water chemistry, *Geochemistry, *Sediments, *Distribution patterns, *Oceans, *Sea water, Sedimentation, Oceanography, Marine geology, Topography, Geophysics, Sedimentation rates, Deposition (Sediments), Movement, Sediment distribution.
Identifiers: *Ocean ridges, Tectonic activity.

Ninety-five sediment samples, taken from traverses across active oceanic ridges were analyzed by emission spectrography for Pb, Ag, Sn, Tl, and Zn. The concentration patterns indicate that processes associated with active oceanic ridges partially affect the distribution of Pb, Tl and Zn. The distribution of Ag is affected only in the Pacific and western Indian Ocean. Sn distribution is not related to any active ridge process. The covariation between distance from a ridge and concentration indicates that the ridge effects are not more than 10%. Average concentrations (weighted by sedimentation rates) were determined for Pb, Ag, Sn, Tl, and Zn in parts of the Pacific, the Atlantic, and the Indian Oceans. On the basis of the high concentrations of Pb, Tl, and Zn in the Pacific, the intermediate concentrations in the Indian Ocean, and the low concentrations in the Atlantic, it is inferred that the East Pacific-Antarctic Ridge system is the most active, the north Mid-Atlantic Ridge is the least active, and the Indian Ocean Ridge system is of intermediate activity. This seems to be in accord with geophysical data for the same regions. (Knapp-USGS)
W71-02436

AUTOMATE KJELDAHL ANALYSES OF NITROGENOUS MATERIALS IN AQUEOUS SOLUTIONS,
National Inst. for Water Research, Pretoria (South Africa).
J. E. Harwood, and D. J. Huyser.
Water Research, Vol 4, No 8, p 539-545, August 1970. 7 p, 2 fig, 26 ref.

Descriptors: *Ammonia, *Nitrogren, *Chemical analysis, *Spectrophotometry, Instrumentation, Automation, Laboratory tests, Measurement.
Identifiers: Automated nitrogen analysis.

A single manifold was developed that could be used for Kjeldahl analyses over a wide range of nitrogen contents. An automated method to determine total nitrogen on liquid samples containing a wide range of nitrogen is based on the separation of ammonia-nitrogen by distillation from the acid digest prior to the determination of the ammonia-nitrogen content. Sensitivity may be altered by changing reagents. The most sensitive method covered the range 0-20 mg per liter with a 15 mm flowcell and no range expansion. (Knapp-USGS)
W71-02439

DETERMINATION OF PENTACHLOROPHENOL IN ORGANIC TISSUES AND WATER,
Swedish Water and Air Pollution Research Lab, Stockholm.
For primary bibliographic entry see Field 05A.
W71-02440

WATER RESOURCES DATA FOR COLORADO-1968: PART 2. WATER QUALITY RECORDS.
Geological Survey, Denver, Colo. Water Resources Div.

Report available from District Chief, Water Resources Div., US Gelogical Survey, Denver Federal Center, Denver, Colo. 80225. Geological Survey Duplicated Basic Data Report, 1969. 97 p, 3 fig, 21 ref.

Descriptors: *Water quality, *Data collections, *Surface waters, *Groundwater, *Colorado, Chemical, analysis, Gaging stations, Streams, Streamflow, Discharge measurement, Sediments, Temperature.
Identifiers: *Basic data, Water quality records.

Water quality data for surface waters in Colorado for the 1968 water year (October 1, 1967 to September 30, 1968) are presented. Data for a few water quality stations in bordering states and selected data on the chemical quality of groundwater in Colorado are also included. Water quality information is presented for chemical quality, fluvial sediment, and water temperatures. The chemical quality includes concentrations of individual dissolved constituents and certain properties or characteristics such as hardness, sodium-adsorption-ratio, specific conductance, and pH. Fluvial sediment information is given for suspended-sediment discharges and concentrations and for particle size distribution of suspended sediment and bed material. Water temperature data represent once-daily observations except for stations where a continuous temperature recorder furnishes information from which daily minimums and maximums are obtained. Of the 100 Irrigation Network stations selected in 1952 (Water Resources Council), 77 are currently operated and the results are published in this report. The stations are at or near certain streamflow gaging sites west of the main stem, Mississippi River. These data are for evaluation of chemical quality of applied water and the quality changes resulting from drainage of irrigated lands. Detailed definitions are given of technical terminology used in the report. (Woodard-USGS)
W71-02470

THE CATIONS OF THE COTTON PLANT IN SODIUM SUBSTITUTED POTASSIUM DEFICIENCY,
Texas Agricultural Experiment Station, College Station.
For primary bibliographic entry see Field 02I.
W71-02504

A STUDY OF THE HAMRA SOIL ASSOCIATION OF ISRAEL,
Technion - Israel Inst. of Tech., Haifa. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 02G.
W71-02519

2L. Estuaries

SEDIMENTS AND SEDIMENTARY PROCESSES OF EASTERN MISSISSIPPI CONE, GULF OF MEXICO,
Florida State Univ., Tallahassee. Dept. of Geology and Florida State Univ., Tallahassee. Dept. of Oceanography.
For primary bibliographic entry see Field 02J.
W71-02209

GROWTH PATTERNS OF DEEP-SEA FANS,
Scripps Institution of Oceanography, San Diego, Calif. Marine Physical Lab.
William R. Normark.
American Association Petroleum Geologists Bulletin, Vol 54, No 11, p 2170-2195, November 1970. 26 p, 25 fig, 2 tab, 46 ref.

Descriptors: *Sedimentation, *Deltas, *Sedimentary structures, *California, Pacific Ocean, Channel morphology, Deposition (Sediments), Sediment transport, Turbidity currents, Continental slope, Surveys, Sounding, Profiles.
Identifiers: *Deep-sea fans.

Mapping of La Jolla and San Lucas deep sea fans, off California and Baja California, with the deep-towed instrument package developed at Marine Physical Laboratory of the Scripps Institution of Oceanography details the fine-scale morphology, structure, and internal fill of the fan-valleys and suggests the growth patterns of these fans. A model for deep-sea fan growth based on this study predicts that deposition on a fan will be localized in a suprafan at the end of large, leveed valleys commonly found on, and generally confined to, the upper reaches of deep-sea fans. The suprafan normally is on the midfan and is characterized by numerous smaller distributary channels. Rapid aggradation in the suprafan coupled with migration and meandering of the channels produces a surface marked by isolated depressions or channel remnants. Uniform deposition, producing a symmetrical half-cone morphology, results from the shifting through time of fan-valleys across the area of the fan. (Knapp-USGS)
W71-02210

ABOVE-BOTTOM ACOUSTIC REFLECTIONS, MISSISSIPPI RIVER DELTA,
Louisiana State Univ., Baton Rouge. Coastal Studies Inst.
L. D. Wright.
American Association of Petroleum Geologists Bulletin, Vol 54, No 11, p 2208-2213, November 1970. 6 p, 3 fig, 1 tab, 15 ref. ONR Project Nonr 1575 (03), Task No 388002.

Descriptors: *Sounding, *Salinity, *Mississippi River, *Density stratification, Stratified flow, Density currents, Tides, Flow, Tidal effects, Deltas, Surveys, Currents (Water), Water circulation, Acoustics, Bathymetry, Fathometers.
Identifiers: *Mississippi delta.

Acoustic fathometric reflections from depths well above the bottom are phenomena commonly observed off the passes of the Mississippi River. These reflections previously have been attributed to an ooze resulting from flocculation. Systematic observations failed to disclose the presence of the ooze or 'sludge' but indicated that the reflections result from strong salinity contrasts. The degree of these contrasts and the presence of the reflections are correlative with the direction of tidal flow. (Knapp-USGS)
W71-02211

EFFECT OF DIAPIRISM ON SEDIMENTATION IN GULF OF MEXICO,
Naval Oceanographic Office, Washington, D.C. Oceanography and Geophysics Branch.
Jack R. Walker, and H. Robert Ensminger.
American Association of Petroleum Geologists Bulletin, Vol 54, No 11, p 2058-2069, November 1970. 12 p, 13 fig, 1 tab, 4 ref.

Descriptors: *Sedimentation, *Structural geology, *Gulf of Mexico, *Geophysics, *Seismic studies, Profiles, Mapping, Instrumentation, Data collections, Sounding, Oil fields, Sea water, Velocity, Deposition (Sediments).
Identifiers: *Diapirism, *Salt domes.

In 1969 an extensive geophysical investigation was made of the Gulf of Mexico. One of the principal measurement systems used was the medium-frequency (3,500 Hz), high-resolution seismic profiler. The seismic profiles provide information about the effects on recent sediments of deposition, water-energy levels, and diapirism. The various stages of sediment deformation and disruption associated with active diapirism and of faulting resulting from salt dome emplacement are observable. The medium-frequency seismic system is a useful tool to aid the study of concurrent deposition during active diapirism and the subsequent environmental effects at the sea floor. Marine sediments that accumulate above an active diapir are profoundly affected by the distortion of the sea floor induced by growing salt intrusions. The accumulation of sediments above diapirs also is related directly to the rate of sediment influx and the energy level of the water. (Knapp-USGS)
W71-02212

NATIONAL ESTUARY STUDY --- VOLUME 1. MAIN REPORT.
Fish and Wildlife Service, Washington, D.C.

For sale by Superintendent of Documents, U S Government Printing Office, Wash, D C 20402 - Price $1.75. House Document No 91-274, 91st Congress, 2d Session, January 1970. 91 p, 16 photo, 11 map.

Descriptors: *Estuaries, *Water pollution effects, *Estuarine environment, *Management, Marsh management, Wildlife management, Habitat improvement, Recreation facilities, Industrial wastes, Planning, Legal aspects, State governments, Regulations, Preservation, Great Lakes, Coastal marshes, Investigations, Water rights, National seashores.
Identifiers: *Estuary P rotection Act, *National estuary study, Land-water interface, Coastal management system.

This is the main report of a 7 vol series prepared by the Department of the Interior in response to the Estuary Protection Act (PL 90-454). Report documents estuary importance and the severity of their modification by man. It demonstrates urgent needs for Congressional enactment of Interior's bill for a comprehensive Coastal Zone Management System. Except for some in Alaska, everyone of the Nation's estuaries has been modified; 23% severely, 50% moderately, and 27% slightly. Half the population utilize them for recreation, including millions who migrate from inland states to fish, sail, etc. Estuaries are favorite places for industry, which finds land cheap, water supply and transportation easy to develop, and waste disposal convenient. Residential developers find it very profitable to dredge and fill estuary areas for affluent people who wish to live near the water. A summary is given of comments from state agencies expressing their views on the feasibility and desirability of establishing a nationwide system of estuarine areas. Almost 75% of them have experienced a need for protection through acquisition where legal controls were inadequate, but only about half the States favored Federal acquisition, mostly with qualifications. (Lang-USGS)
W71-02217

EFFECTS OF PROPOSED BARRIERS ON HURRICAN SURGE HEIGHTS - REPORT 1 OF GALVESTON BAY HURRICANE SURGE STUDY,
Army Engineer Waterways Experiment Station, Vicksburg, Miss.
For primary bibliographic entry see Field 08B.
W71-02243

EFFECTS OF PROPOSED BARRIERS ON TIDES, CURRENTS, SALINITIES, AND DYE DISPERSION FOR NORMAL TIDE CONDITIONS - REPORT 2 OF GALVESTON BAY HURRICANE SURGE STUDY,
Army Engineer Waterways Experiment Station, Vicksburg, Miss.
For primary bibliographic entry see Field 08B.
W71-02244

EFFECTS OF PLAN 2 ALPHA AND PLAN 2 GAMMA BARRIERS ON TIDES, CURRENTS, SALINITIES, AND DYE DISPERSION FOR NORMAL TIDE CONDITIONS - REPORT 3 OF GALVESTON BAY HURRICANE SURGE STUDY,
Army Engineer Waterways Experiment Station, Vicksburg, Miss.
For primary bibliographic entry see Field 08B.
W71-02245

DISTRIBUTION AND TRANSPORTATION OF SUSPENDED SEDIMENT IN UPPER CHESAPEAKE BAY,
Johns Hopkins Univ., Baltimore, Md. Chesapeake Bay Inst.
J. R. Schubel.
Chesapeake Bay Institute Technical Report 60, Reference 69-13, Johns Hopkins University, November 1969. 29 p, 12 fig, 16 ref.

Descriptors: *Estuaries, *Sediment transport, *Provenance, Streamflow, Sedimentation, Currents (Water), Suspended load, Scour, Suspension, Tidal effects, Turbidity, Floods.
Identifiers: Chesapeake Bay, Susquehanna River.

In the upper reaches of the Chesapeake Bay there are two distinctive distributions of suspended sediment, and associated patterns of sediment transport. During the spring freshet the Susquehanna River overpowers the characteristic net non-tidal estuarine circulation in the upper 20-30 km of the estuary and the net flow and sediment transport are seaward at all depths. The marked decrease seaward of the concentration of suspended sediment in the upper Bay reveals the close link, during the freshet, between the suspended sediment population and the principal 'ultimate' source of sediment--the Susquehanna River. With subsiding river flow the net non-tidal estuarine circulation is reestablished in the upper Bay, and a turbidity maximum is formed. The high concentrations of suspended sediment, greater than those either farther upstream in the source river or farther seaward in the estuary, are produced and maintained primarily by the periodic resuspension of bottom sediment by tidal scour, and by the sediment trap created in the upper reaches of the estuarine circulation regime. (Knapp-USGS)
W71-02258

TRANSIENT CHARACTERISTICS OF SALT-WATER WEDGE,
Saitama Univ., Urawa (Japan). Dept. of Foundation Engineering.
For primary bibliographic entry see Field 02F.
W71-02262

CONTROL OF SEA WATER LEVEL IN COASTAL POROUS MEDIA BY MEANS OF DOUBLE PUMPING,
Kyoto Univ. (Japan). Dept. of Civil Engineering.
Yoshiaki Iwasa, and Hitoshi Takeuchi.
French synopsis. In: Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 4 (Subject D), Science Council of Japan, Kyoto, p 391-400, 1969. 10 p, 14 fig, 1 tab, 4 ref.

Descriptors: *Groundwater movement, *Saline water-freshwater interfaces, *Aquifers, Porous media, *Mathematical models, Equations, Computers, Withdrawal, Pumping, Water resources, Water supply.
Identifiers: Coastal aquifers, Double pumping.

The mathematical theory of the selective withdrawal for fresh and sea waters by means of double pumping under several assumptions is studied. The numerical calculations for the mathematical model derived are made by the electronic computer. The results obtained are also compared with the experimental verification made in an experimental basin at the hydraulics laboratory. The double pumping technique should be useful in the utilization of fresh water in coastal aquifers. (Woodard-USGS)
W71-02265

PHENOMENA OF TURBULENT HORIZONTAL TRANSPORT AND DIFFUSION IN THE TIDAL COASTAL SEAS AND APPLICATION TO THE ENGLISH CHANNEL,
Grenoble Univ. (France). Faculte des Sciences.
Jean Louis Hyacinthe.
Available from NTIS as N70-17225, $3.00 in paper copy, $0.95 in microfiche. 1969. 158 p, 20 fig, 87 ref.

Descriptors:
Identifiers: *Tides, *Transport properties, *Turbulent diffusion, *Waste disposal, Coasts, Incompressible fluids, Magnetohydrodynamics, Mathematical models, Mixing length flow theory, Radioactive wastes, Rotating fluids, Scale effect, Seas, Stratified flow, Turbulent mixing.

Classical results on the homogeneous or isotropic turbulent transport properties of an incompressible fluid are compared. Theoretical and experimental results for marine and oceanic turbulent flows and horizontal turbulent transport are summarized and applied to tidal coastal waters, especially those of the English Channel. A direct experiment using buoys and coloring materials was carried out in order to choose between different hypotheses and scale laws. A rotating hydraulic model was designed to simulate tidal effects in the English Channel in order to evaluate nuclear waste disposal sites.
W71-02305

SEAWATER INTRUSION LENGTH IN STRATIFIED ESTUARIES,
Norsk Institutt for Vannforskning, Oslo.
Y. F. Ozturk.
Water Research, Vol 4, No 7, p 477-484, July 1970. 8 p, 5 fig, 1 ref.

Descriptors: *Saline water intrusion, *Estuaries, *Stratified flow, *Length, *Model studies, Saline water-Freshwater interfaces, Mixing, Sea water, Equations, Theoretical analysis, Density stratification, Velocity, Streamflow, Flow rates, Tides, Meteorology, Channel morphology.
Identifiers: Stratified estuaries.

The hydrodynamical evaluation of the sea-water intrusion length is based on the theory of density currents. Although the geometry of estuaries may vary from place to place the experimental estuaries used for this purpose are usually the channels of constant shape which do not include the influence of the local variations in depth, width, velocity and salinity. For the analysis of theoretical principals of sea-water intrusion length, the estuary of rectangular cross-section containing distinctly separated river-water and sea-water layers, is considered. The validity of the experimental material presented rests on the simplified estuary models, in which the effect of tide, estuary geometry and Reynolds number for the river have been neglected during

the experiments. It is concluded that by some developed model estuary or sufficient data obtained from the real estuary, the determination and introduction of estuary shape factor and Reynolds number for the river into the sea-water intrusion length equation may be possible. For the practical evaluation of arrested sea-water wedge lengths in any stratified estuary, the knowledge about the densities of sea water and river water, kinematic viscosity of river water, depth of river at the estuary mouth, velocity of river flow at the tip of wedge, and corresponding length of sea-water wedge is sufficient. (Woodard-USGS)
W71-02435

THE DISTRIBUTION OF Pb, Ag, Sn, Tl, AND Zn IN SEDIMENTS ON ACTIVE OCEANIC RIDGES,
Miami Univ., Fla. Inst. of Marine and Atmospheric Sciences.
For primary bibliographic entry see Field 02K.
W71-02436

HYDROCARBON POLLUTION OF EDIBLE SHELLFISH BY AN OIL SPILL,
Woods Hole Oceanographic Institution, Mass.
For primary bibliographic entry see Field 05C.
W71-02475

A STUDY OF ECONOMIC VALUE OF INCREASED ESSA SERVICES AS RELATED TO ESTUARINE DYNAMICS IN GULF COAST ESTUARIES, VOLUME I,
Gulf Universities Research Corp., Galveston, Tex.
James M. Sharp, Dan E. Feray, Ronald F. Bearden, Thomas W. Bilhorn, and Joseph R. Crump.
Available from NTIS as PB-193 722, $3.00 in paper copy, $0.95 in microfiche. Summary Technical Report, August 1970. 73 p, 9 fig. ESSA Contract E-189-69 (N).
Identifiers: *Estuaries, *Economics, Management planning, Costs, Recreation, Weather forecasting, Storms, Minerals, Aquatic animals, Natural resources, Erosion, Water pollution, Sedimentation, Mexico Gulf, Gulf Coast (US), Coastal zone management.

An initial effort was made to determine the economic benefits to be derived from a description and prediction of the dynamic behavior of estuaries, or inland water areas, along the United States margin of the Gulf of Mexico. Such services have not yet been established; therefore, service costs were derived from conceptual design studies and estimates of operation and maintenance requirements. Since the services have not been in use, data have not been accumulated which would permit the determination of economic benefits on the basis of statistical treatment. (See also W71-02607).
W71-02606

A STUDY OF ECONOMIC VALUE OF INCREASED ESSA SERVICES AS RELATED TO ESTUARINE DYNAMICS IN GULF COAST ESTUARIES, VOLUME II, APPENDICES,
Gulf Universities Research Corp., Galveston, Tex.
Thomas E. Hawkins.
Available from NTIS as PB-194 077, $3.00 in paper copy, $0.95 in microfiche. Appendixes to Volum I, January 1970. 151 p.
Identifiers: *Economic development, *Benefit cost analysis, *Estuaries, Economic development, *Management planning, *Econometrics, Mathematical models, Inland waterways, Beaches, Dredging, Sediment transport, Temperature, Salinity, Water flow, Remote sensors, Tidegages, Shallow water, Data processing systems, *Gulf Coast estuaries, Galveston Bay, *Estuarine dynamics.

The need for knowledge of estuarine dynamics (Need for mass flow measurements; need for water level measurements; need for water temperature measurements; need for systems approach) Overall program concepts (The instrumentation concept; the model concept); Program and program costs (Galveston Bay program definition; Galveston Bay program costs; long-term program and program costs). (See also W71-02606).
W71-02607

03. WATER SUPPLY AUGMENTATION AND CONSERVATION

3A. Saline Water Conversion

BUDGETARY CAPITAL COST ESTIMATES OF 1- TO 10-MGD MULTISTAGE FLASH DISTILLATION PLANTS FOR DESALTING SEA-WATER,
Oak Ridge National Lab., Tenn.
R. A. Greene, S. A. Senatore, and R. A. Ebel.
Available from NTIS as PB-193 689, $3.00 in paper copy, $0.95 in microfiche. ORNL-TM-3083, August 1970. 40 p, 12 fig, 14 tab, 2 ref. AEC Contract W7405-Eng-26, OSW Agreement No 14-30-2535.
Identifiers: *Desalination, Costs, *Distilling plants, Sea water, Programming (Computers), Pipes, Fixed investment.

By means of a computer program, capital costs were estimated for several multistage flash (MSF) desalting plants in the 1-10-Mgd size range. The plant design was assumed to be similar to the OSW 'Universal Plant' design. The report tabulates changes in capital cost estimates as a result of variations in performance ratio, tubing price, copper-nickel vs titanium tubing, flow velocity in tubes, number of vessels in the plant, number of stages, and seawater feed temperature. For all capital cost summaries, the tabulations show a breakdown into the following categories: seawater intake, sitework, buildings, evaporator, shell, pumps and motors, valves and piping, chemical systems, instruments, electrical, deaerator, brine heater, and indirect costs.
W71-02609

3B. Water Yield Improvement

GROUND RAINFALL DATA FOR THE 1968 FLORIDA CLOUD SEEDING EXPERIMENT,
Environmental Data Service, Silver Spring, Md.
B. G. Holzman, and Thom Marcella.
Available from NTIS as PB-194 366, $3.00 in paper copy, $0.95 in microfiche. Essa Technical Memorandum EDSTM 17, August 1970. 15 p, 11 fig, 2 ref.

Descriptors:
Identifiers: *Cloud seeding, Florida, Meteorological charts, Wind, Fronts (Meteorology), Velocity.

Maps of ground rainfall data are depicted for the Research Laboratories' 1968 Florida cloud seeding experiment. These maps are for information only, and no conclusions are drawn for the verification of enhanced rainfall from seeded clouds.
W71-02301

A STUDY OF THE PRODUCTION AND DETECTION OF ARTIFICIAL ICE NUCLEI,
Denver Research Inst., Colo.
Norihiko Fukuta, L. F. Evans, Young H. Paik, William A. Schmeling, and Louise A. Walter.
Available from NTIS as PB-194 129, $3.00 in paper copy, $0.95 in microfiche. Final Report for Bureau of Reclamation, July 1970. 65 p, 8 tab, 19 fig, 25 ref. BuRec Contract No 14-06-D-6444.

Descriptors: Weather modification.
Identifiers: *Cloud seeding, Artificial precipitation, *Ice, Nucleation, Crystal growth, Detection, Aerosol generators, Spraying, Cloud physics, Vapors, Condensation nuclei, Freezing, Silver iodide, Supercooling.

The present major task of weather modification engineering is the optimization of the seeding effect which depends on the purpose of seeding and the type and condition of the given cloud system. Toward this objective, a study of many subjects has been carried out concerning the production and detection of ice nuclei, and growth of the formed ice crystals. Major achievements are as follows: development of organic ice nuclei generators; development of airborne volatile liquid ice crystal generators; development of a slow activation ice-nucleus counter; and development of ice crystal growth theory from vapor.
W71-02304

3C. Use of Water of Impaired Quality

CITY OF SAN DIEGO WATER RECLAMATION STUDY FOR BALBOA PARK AND MISSION BAY PARK.
Boyle Engineering, San Diego, California.
For primary bibliographic entry see Field 05D.
W71-02287

HODGES V TOWN OF BLUFF CITY (ACQUISITION OF WATER RIGHTS).
For primary bibliographic entry see Field 06E.
W71-02327

3D. Conservation in Domestic and Municipal Use

POTOMAC-SHENANDOAH RIVER BASIN COMPREHENSIVE WATER RESOURCES PLAN: VOLUME 5-ENGINEERING DEVELOPMENT ALTERNATIVES.
Virginia Dept. of Conservation and Economic Development, Richmond. Div. of Water Resources.
For primary bibliographic entry see Field 06B.
W71-02216

HARVEY REALTY CO V BOROUGH OF WALLINGFORD (RIPARIAN RIGHTS AND PROTECTION OF PUBLIC WATER SUPPLY).
For primary bibliographic entry see Field 06E.
W71-02314

PUBLIC WATER SUPPLIES IN LOUISIANA,
Geological Survey, Baton Rouge, La.
Don C. Dial.
Louisiana Department of Public Works Basic Records Report No 3, 1970. 460 p, 14 fig, 1 tab, 22 ref.

Descriptors: *Municipal water, *Data collections, *Water supply, *Water utilization, *Louisiana, Groundwater, Aquifers, Surface waters, Water sources, Mississippi River, Lakes, Public utilities.
Identifiers: *Public water supplies, Basic data.

This report contains water-supply information for 291 municipalities, parish water districts, and most privately owned water districts. Groundwater is used by 246 municipalities and water districts, and surface water by 45. The following information, if applicable, is given for each facility: owner, source of supply, population, number of services, treatment procedure, pumpage, well logs, and chemical analyses of water samples. Mechanical analyses of sand samples and aquifer-test results are included to the extent that such results are available. Fresh water is available in 6 major aquifer systems ranging in age from Paleocene to Pleistocene. Southeastern parishes are underlain by as many as 15 fresh-water-bearing sands, and most towns obtain supplies from two or more aquifers. Large quantities of water are provided by the mississippi and Atchafalaya Rivers. Almost all towns downstream from Iberville Parish use water from the Mississippi, which must be treated for public needs. Intrusion of salty water from the Gulf must

be monitored in the lower reaches. A total of 377 mgd of water is pumped for Louisiana public supplies. (Lang-USGS)
W71-02451

3E. Conservation in Industry

PUBLIC WATER SUPPLIES IN LOUISIANA,
Geological Survey, Baton Rouge, La.
For primary bibliographic entry see Field 03D.
W71-02451

3F. Conservation in Agriculture

GLASS-FIBER REINFORCED POLYESTER LINING,
Bureau of Reclamation, Denver, Colo. Office of Chief Engineer.
For primary bibliographic entry see Field 08G.
W71-02300

HYDROLOGY OF SPRAY-RUNOFF WASTE WATER TREATMENT,
Robert S. Kerr Water Research Center, Ada, Okla.
For primary bibliographic entry see Field 05D.
W71-02437

GRAZING STUDIES IN THE ARID AND SEMI-ARID ZONES OF RAJASTHAN. VII: UTILIZATION OF VEGETATION COVER, GRAZING BEHAVIOUR OF SHEEP AND SEASONAL VARIATION OF CRUDE PROTEIN CONTENT OF PLANTS IN DIFFERENT PASTURES,
Central Arid Zone Research Inst., Jodhpur (India).
A. K. Chakravarty, Ram Ratan, and K. C. Singh.
Annals of Arid Zone, Vol 9, No 1, p 10-16, March 1970. 2 fig, 4 tab, 1 ref.

Descriptors: *Forage grasses, *Arid lands, *Grazing, *Sheep, Ecology, Forage palatability, Pasture management, Plant groupings, On-site investigations, Xerophytes, Herbivores, Environmental effects, Proteins, Rainfall, Animal behavior, Data collections, Monthly, Seasonal, Semiarid climates, Range grasses, Variability, Vegetation effects.
Identifiers: *India, *Protein content (Crude), *Basal cover, Annual grasses, Perennial grasses.

In arid zones, knowledge of the overall value of herbage in different seasons is important for sheep farming. Utilization and crude protein content of pasture plants and ewe grazing behavior were studied for 10.5 months in 4 different pasture paddocks sown with various combinations of Rajasthan range grasses. During this period, there were 6 months of no rainfall and 4 months of over 60 mm. Monthly data were recorded on crude protein content and basal cover before and after grazing. General protein status is comparatively low except during the July-September rainy season. Over the year, crude protein percentages varied from 2.8-9.2 for perennials and from 12.4-17.3 for the better annuals. In terms of grazing stress resistance and basal cover increase, the most promising grasses, in order, were Cenchrus ciliaris, C. setigerus and Lasiurus sindicus. Most of the annuals appeared during the rainy season and the most palatable were Brachiaria ramosa, C. microphyllus, Indigofera cordifolia and I. linifolia. (Casey-Arizona)
W71-02501

BROWN STEPPE SOIL IN THE UPPER PART OF WADI EATEL (NORTHWEST TRIPOLITANIA),
Institute for Soil Research, Belgrade (Yugoslavia).
For primary bibliographic entry see Field 02G.
W71-02502

SPECIALIZATION OF AGRICULTURE IN RELATIVELY SIMILAR NATURAL ENVIRONMENTS OF THE USSR AND THE UNITED STATES,
Moscow State Univ. (USSR).
A. Ye. Granovskaya.
Translated from: Vestnik Moskovskogo Universiteta, Geografiya, No 4, p 79-90, 1968.
Soviet Geography: Review and Translation, Vol 9, No 8, p 830-837, 1968. 1 fig, 7 ref.

Descriptors: *Geographical regions, *Soil types, *Climatic zones, *Regional analysis, Temperature, Water balance, Arid lands, Semiarid climates, Humid areas, Comparative productivity, Wheat, Forages, Dairy industry, Montana, North Dakota, Minnesota, Chernozems, Chestnut soils, Forest soils, Podzols, Agriculture, Grazing, Crop production, Data collections, Grasslands, Grains (Crops), Land use.
Identifiers: *USSR, *Temperature-sum isolines, *Comparative regional studies, Animal production.

Agricultural land-use comparisons between differing countries require some means of standardizing the physical attributes of comparable regions. Minor civil divisions in the U. S. (counties) and the USSR (rayons) were related on the basis of soil types and climate (temperature and moisture conditions). In each geographical zone one civil division from each country was compared. The 4 similar zones studied were: (1) dry steppe and chestnut soils, (2) moderately dry steppe and chernozem soils, (3) broadleaf forest and gray forest soils and (4) needleleaf forest and sod-podzolic soils. The comparisons suggest that agricultural differentiation by physical zone is quite different in the two countries. Animal products predominate in all U. S. zones except the very dry steppe where grains were sharply dominant. Grain yields, dairying and forage crops increased along the gradient of negative to positive water balance. In the USSR, such interzonal differences were less pronounced in forage production while crop and grain production rose markedly from dry to humid areas. The Soviets relegate animal production to a secondary role and derive their principle income from bread grains and industrial row crops. (Casey-Arizona)
W71-02510

HOW GREEN IS THE GREEN REVOLUTION,
For primary bibliographic entry see Field 06B.
W71-02513

INFLUENCE OF SOIL TEMPERATURE, IRRIGATION AND AERATION ON HEMICYCLIOPHORA ARENARIA,
California Univ., Riverside.
For primary bibliographic entry see Field 02I.
W71-02517

USE OF POULTRY MANURE FOR CORRECTION OF Zn and Fe DEFICIENCIES IN PLANTS,
Colorado State Univ., Fort Collins. Dept. of Agronomy.
For primary bibliographic entry see Field 05D.
W71-02717

DISPOSAL OF DAIRY CATTLE WASTES BY AERATED LAGOONS AND IRRIGATION,
Purdue Univ., Lafayette, Ind. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 05D.
W71-02720

04. WATER QUANTITY MANAGEMENT AND CONTROL

4A. Control of Water on the Surface

ERROR CRITERIA IN WATER SURFACE PROFILE COMPUTATIONS,
Massachusetts Inst. of Tech., Cambridge. Dept. of Civil Engineering.
For primary bibliographic entry see Field 02E.
W71-02201

NUMERICAL SOLUTION OF UNSTEADY FLOWS IN OPEN CHANNELS,
Massachusetts Inst. of Tech., Cambridge. Dept. of Civil Engineering.
For primary bibliographic entry see Field 02E.
W71-02202

FLOOD PLAIN INFORMATION, ROCKY AND WOLF CREEKS, MACON AND BIBB COUNTY, GEORGIA.
Corps of Engineers, Savannah, Ga.

Corps of Engineers Flood Plain Report, June 1970. 48 p, 24 fig, 52 plate, 13 tab.

Descriptors: *Floods, *Flood damage, *Georgia, Flood plains, Regional flood, Flood forecasting, Flood control, Streamflow, Flow measurement, Historic flood.
Identifiers: *Flood records, Standard project flood, Intermediate regional flood.

Flooding along Rocky and Wolf Creeks in and near Macon in Bibb County, Georgia is described to aid in solving local flood problems and in planning the best utilization of flood-prone lands. Maps, profiles, cross sections, and test material relating the extent of past flooding to floods which might occur in the future are based on available records of rainfall, runoff, historical flood heights and other technical data. (Woodard-USGS)
W71-02214

EFFECTS OF PROPOSED BARRIERS ON HURRICAN SURGE HEIGHTS - REPORT 1 OF GALVESTON BAY HURRICANE SURGE STUDY,
Army Engineer Waterways Experiment Station, Vicksburg, Miss.
For primary bibliographic entry see Field 08B.
W71-02243

EFFECTS OF PROPOSED BARRIERS ON TIDES, CURRENTS, SALINITIES, AND DYE DISPERSION FOR NORMAL TIDE CONDITIONS - REPORT 2 OF GALVESTON BAY HURRICANE SURGE STUDY,
Army Engineer Waterways Experiment Station, Vicksburg, Miss.
For primary bibliographic entry see Field 08B.
W71-02244

EFFECTS OF PLAN 2 ALPHA AND PLAN 2 GAMMA BARRIERS ON TIDES, CURRENTS, SALINITIES, AND DYE DISPERSION FOR NORMAL TIDE CONDITIONS - REPORT 3 OF GALVESTON BAY HURRICANE SURGE STUDY,
Army Engineer Waterways Experiment Station, Vicksburg, Miss.
For primary bibliographic entry see Field 08B.
W71-02245

HYDRODYNAMICS OF FLOW IN POROUS MEDIA,
Technische Universitaet, Dresden (East Germany).
Ludwig Luckner, Gunther Mueller, and Joachim Quast.

French resume. In: Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 4 (Subject D), Science Council of Japan, Kyoto, p 411-421, 1969. 11 p, 9 fig, 11 ref.

Descriptors: *Groundwater movement, Seepage, *Underseepage, *Levees, *Dams, Mathematical models, Equations, Aquifer characteristics, Flow, Infiltration, Hydraulic gradient, Leakage, Permeability, Water levels, Drainage.

Mathematical models of some typical sections of groundwater flow fields (confined flow, leaky water-bearing strata, flow to incomplete ditches, series of wells, etc.), with the fundamentals of the derivation of these mathematical relations, as well as with the interlacing laws dealing with these sections, are presented. The practical use of hydraulic network schemes is described using dam and dike seepage as an example and it is shown that this method can be used for solving very complex flow problems. It is demonstrated that this method of calculation can be used also for geohydraulic problems of underseepage in the case of massive hydraulic structures and for problems of bank filtration, artificial groundwater enrichment, opencast mine drainage, and many other problems. (Woodard-USGS)
W71-02260

FILTRATION CALCULATIONS OF HORIZONTAL AND VERTICAL DRAINAGES IN NONUNIFORM STRATIFIED SOILS,
Akademiya Nauk URSR, Kiev.
For primary bibliographic entry see Field 02G.
W71-02270

FLOOD PLAIN INFORMATION, CITY OF ALEXANDRIA AND ARLINGTON COUNTY, VIRGINIA, FOURMILE RUN.
Corps of Engineers, Baltimore, Maryland.

Report, October 1968. 38 p, 11 fig, 7 tab.

Descriptors: *Flood forecasting, *Flood plains, *Flood damage, *Storm runoff, *Urbanization, Maximum probable flood, Planning, Flood control, Flood plain zoning, Floodproofing, Runoff, Virginia, Streamflow forecasting, Drainage, Regional flood, Land development, Flash floods.
Identifiers: *Fourmile Run, Arlington County, Alexandria, Arlandria.

Flooding was studied on the lower 3 miles of Fourmile Run, a floodway draining 18.5 square miles that flows 9 miles through Arlington County, along the northern boundary of Alexandria, Virginia, and discharges into the Potomac River downstream of Washington National Airport. During the largest flood of record, in August 1963, damage to business properties in a four-block stretch of Arlandria was estimated at more than one million dollars. Two significant phases are covered of the Fourmile Run flood problem: (1) the largest known floods, and (2) probable future floods. Estimates are made of the maximum velocities, discharge rates, and flood depths that would result from a flood having a 100 year average recurrence interval, and from the maximum probable flood that could ever be anticipated in the area. This latter flood would top the flood depth of record by 10.3 feet on Mount Vernon Avenue in Arlandria, and discharge 25,000 cfs at its peak. The report is intended to provide the basis for further study and planning by Arlington County and Alexandria to develop solutions. The report contains maps, profiles and cross-sections that indicate the extent of future flooding anticipated. These can be used to guide and plan land developments, and to formulate zoning ordinances and subdivision regulations. They can also be used in planning flood protection works. (Poertner)
W71-02285

REPORT ON FOURMILE RUN FLOODING, ALEXANDRIA, VIRGINIA.
Greeley and Hansen, Chicago, Illinois.
For primary bibliographic entry see Field 08A.
W71-02286

APPLICATION OF GILLESPIE (COMPENSATION FOR DAMAGE CAUSED BY INCREASE IN VOLUME OF FLOW).
For primary bibliographic entry see Field 06E.
W71-02295

CHELTENHAM AND ABINGTON SEWERAGE CO V PUBLIC SERVICE COMM'N (OWNERSHIP OF STORM DRAINAGE SYSTEM).
For primary bibliographic entry see Field 06E.
W71-02309

THE EFFECTIVENESS OF FLOOD CONTROL STRUCTURES OF THE LOWER MINNESOTA RIVER WATERSHED DISTRICT.
Lower Minnesota River Watershed District, Burnsville.

Available from NTIS as PB-196 114, $3.00 in paper copy, $0.95 in microfiche. Lower Minnesota River Watershed District and Office of Water Resources Research Cooperative Report, July 1970. 136 p, 61 fig, 7 tab, 22 ref, 3 append. OWRR Project C-1239 (No 1602) (1).

Descriptors: *Flood control, *Flood protection, *Flood plain zoning, *Non-structural alternatives, *Minnesota, Floodproofing, Regulation, Zoning, Building codes, Flood plains, Overflow, River basin development, Cost-benefit analysis, Levees, Channel improvement, Frequency analysis, Flood damage, Data collections.
Identifiers: *Minnesota River.

Flood protective structures in the Lower Minnesota River Watershed District, properly planned and constructed, are economical in providing protection against potential floods from the Minnesota River only for existing installations. New construction in the flood plain should include flood protection by proper location of structures as an integral part of the original design. In most cases, capital improvements should be made above the flood plain and far enough away from the main channel of the Minnesota River so as not to unduly restrict flood flows. Proper flood plain management and zoning could eliminate the need for structural measures of flood protection. Dikes, bulkheads, sandbagging, dams, and other structures would not be necessary if the flood plain were developed according to sound flood plain management principles. There is no economic necessity for flood protective structures on agricultural lands even though the land is flooded on an average of once a year. Agricultural use of the flood plain does not restrict high flows and is, therefore, a good use of the flood plain. Low cost flood plain management is the most economical means of reducing and eliminating both losses and the need for further protection. (Knapp-USGS)
W71-02312

NORTHERN IND POWER CO V CASTOR (ACQUISITION OF PRESCRIPTIVE RIGHT TO FLOOD LAND).
For primary bibliographic entry see Field 06E.
W71-02316

COLLINS V GERHARDT (OWNERSHIP OF BEDS OF NAVIGABLE RIVER SUBJECT TO RIGHTS OF NAVIGATION IN PUBLIC).
For primary bibliographic entry see Field 06E.
W71-02317

MORGAN V KLOSS (CONSTRUCTION OF BRIDGE TO ISLAND IN NAVIGABLE LAKE FOR PRIVATE PURPOSES).
For primary bibliographic entry see Field 06E.
W71-02318

FOX RIVER PAPER CO V RAILROAD COMM'N (ACQUISITION OF LICENSE FOR DAM OPERATION).
For primary bibliographic entry see Field 06E.
W71-02320

SOUTHERN RY V THACKER (LIABILITY FOR OBSTRUCTING PROPERTY'S NATURAL DRAINAGE).
For primary bibliographic entry see Field 06E.
W71-02321

DAVIS V GULF AND I RY OF TEXAS (SHALLOW AND CROOKED STREAM NOT NAVIGABLE WATERWAY).
For primary bibliographic entry see Field 06E.
W71-02325

WABASH RR V LEWIS (LIABILITY FOR FLOODING CAUSED BY INSUFFICIENT DRAINAGE THROUGH RAILROAD EMBANKMENT).
For primary bibliographic entry see Field 06E.
W71-02328

NORFOLK AND W RY V MCCOY (LIABILITY OF RAILROAD FOR RIVERFILL CAUSING OVERFLOW).
For primary bibliographic entry see Field 06E.
W71-02330

KELLY V NAGLE (RIPARIAN RIGHT TO THE NATURAL FLOW OF A STREAM).
For primary bibliographic entry see Field 06E.
W71-02332

CENTRAL OF GEORGIA RY V FAULKNER (LIABILITY FOR CHANGE IN EXISTING DRAINAGE PATTERN).
For primary bibliographic entry see Field 06E.
W71-02337

COVINGTON V CASSIDY BAYOU DRAINAGE DIST (RIPARIAN OWNERS' RIGHT TO, THROUGH A DRAINAGE DISTRICT, PROTECT AGAINST FLOOD BY OBSTRUCTION OF A WATERCOURSE).
For primary bibliographic entry see Field 06E.
W71-02338

SS KRESGE CO V RAILROAD COMM'N (RIGHT TO CONSTRUCT BUILDING ON BED OF STREAM).
For primary bibliographic entry see Field 06E.
W71-02342

CALDWELL V GORE (DUTY OF LOWER ESTATE TO ACCEPT NATURAL DRAINAGE FROM UPPER ESTATE).
For primary bibliographic entry see Field 06E.
W71-02349

ATLANTIC COAST LINE RR V HENDRY (LIABILITY OF RAILROAD FOR FAILURE TO PROVIDE DRAINAGE UNDER TRACKS).
For primary bibliographic entry see Field 06E.
W71-02351

UNITED PAPERBOARD CO V IROQUOIS PULP AND PAPER CO (INTERPRETATION OF DEED WITH RESERVED WATER RIGHTS).
For primary bibliographic entry see Field 06E.
W71-02354

PEOPLE V NEW YORK AND ONTARIO POWER CO (OWNERSHIP OF BEDS OF NAVIGABLE STREAMS).
For primary bibliographic entry see Field 06E.

W71-02355

PIGEON RIVER IMPROVEMENT, SLIDE AND BOOM CO V CHARLES W COX, LTD (USE AND CONTROL OF STREAMS WHICH FORM AN INTERNATIONAL BOUNDARY).
For primary bibliographic entry see Field 06E.
W71-02357

WYOMING V COLORADO (ENFORCEMENT OF JUDICIAL DECISION SETTING OUT RELATIVE RIGHTS OF ADJOINING STATES TO QUANTITY OF WATER DIVERTED FROM NAVIGABLE RIVER).
For primary bibliographic entry see Field 06E.
W71-02358

ARKANSAS POWER AND LIGHT CO V ORR (LIABILITY FOR FLOOD DAMAGE CAUSED BY NEGLIGENT FLOODGATE OPERATION).
For primary bibliographic entry see Field 06E.
W71-02360

PRUYN V NELSON BROS (BATTURE LAND SUBJECT TO PUBLIC SERVITUDE FOR USE IN CONSTRUCTING AND REPAIRING LEVEES).
For primary bibliographic entry see Field 06E.
W71-02362

ARKANSAS POWER AND LIGHT CO V BEAUCHAMP (NEGLIGENCE IN DAM OPERATION AS CAUSE OF FLOODING).
For primary bibliographic entry see Field 06E.
W71-02365

MISSOURI PAC RR V BAKER (LIABILITY FOR FLOOD DAMAGE CAUSED BY CLOGGED CULVERT).
For primary bibliographic entry see Field 06E.
W71-02366

ZOOK V CITY OF LOUISIANA (BLOCKAGE OF DRAIN CAUSED BY CITY'S PAVING OF STREET).
For primary bibliographic entry see Field 06E.
W71-02369

KENTUCKY ELEC DEV CO'S RECEIVER V WELLS (LIABILITY FOR DAMAGE CAUSED BY DAM MAINTAINED AT UNAUTHORIZED HEIGHT DURING UNPRECEDENTED FLOOD).
For primary bibliographic entry see Field 06E.
W71-02370

TOLER V BEAR CREEK DRAINAGE DIST (AUTHORITY OF DRAINAGE DISTRICT TO DIVERT WATER FROM WATERSHED).
For primary bibliographic entry see Field 06E.
W71-02371

DALY V STATE (NO OBLIGATION RESTS ON STATE TO PROTECT LANDS THAT WOULD BE FLOODED EVEN IN ABSENCE OF STATE-CONSTRUCTED CANAL).
For primary bibliographic entry see Field 06E.
W71-02376

HAYS V HOFFMAN (OBSTRUCTION OF DRAINAGE DITCH ALLEGED TO HAVE CAUSED OVERFLOW).
For primary bibliographic entry see Field 06E.
W71-02380

TAYLOR V LEXINGTON WATER POWER CO (NEGLIGENT RELEASE OF FLOODWATERS FROM DAM).
For primary bibliographic entry see Field 06E.
W71-02381

FAIREY V SOUTHERN RY (RAILROAD EMBANKMENT ALLEGED TO HAVE DAMMED SURFACE RUNOFF).
For primary bibliographic entry see Field 06E.
W71-02382

BYRD V PENNSYLVANIA RR (OVERFLOW DAMAGE CAUSED BY PLUGGED RAILROAD CULVERT AFTER HEAVY RAINFALL).
For primary bibliographic entry see Field 06E.
W71-02383

HUGGINS V ATLANTIC COAST LINE RR (RAILROAD FILL ALLEGED TO HAVE CAUSED FLOODWATER DAMAGE).
For primary bibliographic entry see Field 06E.
W71-02385

LEITCH V CITY OF CHICAGO (FEDERAL JURISDICTION OF CASES INVOLVING NAVIGABLE STREAMS).
For primary bibliographic entry see Field 06E.
W71-02387

WASHBURN V CAMPBELL (PAROL PERMISSION AS MERE LICENSE TO MAINTAIN DAM).
For primary bibliographic entry see Field 06E.
W71-02389

HUNTER V CLEVELAND, C C AND ST L RY (COLLECTION AND DISCHARGE OF WATER IN VOLUME PROHIBITED).
For primary bibliographic entry see Field 06E.
W71-02390

CASHIN V CITY OF NEW ROCHELLE (DAMAGES FROM OVERFLOW OF STREAM).
For primary bibliographic entry see Field 06E.
W71-02391

BEAN V CENTRAL MAINE POWER CO (APPROPRIATION OF WATER CURRENT).
For primary bibliographic entry see Field 06E.
W71-02392

BALDWIN V NEAL (LIABILITY FOR OBSTRUCTION OF STREAM FLOW BY INADEQUATE PASSAGEWAYS UNDER RAILROAD BRIDGE).
For primary bibliographic entry see Field 06E.
W71-02394

LEISL V CITY OF NEWPORT (LIABILITY FOR OVERFLOW RESULTING FROM INADEQUACY OF CULVERT).
For primary bibliographic entry see Field 06E.
W71-02395

FORKNER V CHESAPEAKE AND O RY (RESTORATION OF NATURAL DRAINAGE COURSE BY CULVERT).
For primary bibliographic entry see Field 06E.
W71-02396

FRANK V DIERSON (LIABILITY FOR ALTERATION OF NATURAL DRAINAGE DIRECTION).
For primary bibliographic entry see Field 06E.
W71-02398

WALTER V WAGNER (FLOOD DAMAGE CAUSED BY LANDFILL).
For primary bibliographic entry see Field 06E.
W71-02399

KIGER V SANKO (DAMAGE CAUSED BY EXCESSIVE SURFACE RUNOFF).
For primary bibliographic entry see Field 06E.
W71-02400

ROSITZKY V BURNES (FLOOD DAMAGE TO ADJACENT BUILDING CAUSED BY OVERFLOW FROM ROOF).
For primary bibliographic entry see Field 06E.
W71-02401

YOUNG V ILLINOIS CENT RR (RAILROAD EMBANKMENT ALLEGED TO HAVE OBSTRUCTED NATURAL DRAINAGE, CAUSING FLOOD DAMAGE).
For primary bibliographic entry see Field 06E.
W71-02402

CALDWELL V GORE (INTERSTATE SURFACE RUNOFF: LOWER SERVITUDE).
For primary bibliographic entry see Field 06E.
W71-02403

MEYERS V BEAUCHAMP (RIGHT OF RIPARIAN OWNER TO PROTECT HIS LAND).
For primary bibliographic entry see Field 06E.
W71-02405

HUTCHINGS V WABASH RY (UPSTREAM OWNER'S DIVERSION OF WATERCOURSE).

33 SW2d 147-149 (Mo 1930).

Descriptors: *Missouri, *Diversion, *Obstruction to flow, *Erosion, Legal aspects, Judicial decisions, Flow, Rivers, Real property, Land, Railroads, Bridges, Streams, Streamflow, Bank erosion, Stream erosion, Damages, Bank stability, Riparian rights, Relative rights, Reasonable use, Embankments.
Identifiers: Revetment.

Defendant railroad constructed a trestle and bridge across a river. When the force of the river current began to wear away the railroad right-of-way, defendant constructed a rock revetment. The water struck the revetment and was diverted with such force that the river channel was altered, eroding plaintiff's property below the bridge. Plaintiff sought damages for permanent injury to his property, contending that defendant was collecting water upstream of the bridge and causing it to discharge onto his property. The Kansas City Court of Appeals affirmed a judgment for defendant, stating that defendant was within its rights in preventing erosion of its property. Plaintiff's loss was merely incidental to defendant's exercise of its right. There was no showing of negligence in defendant's construction of the embankment. (Dye-Florida)
W71-02406

HARTZELL V VILLAGE OF HAMBURG (VILLAGE BOUND TO ACQUIRE WATER SUPPLY FOR PUBLIC USE BY CONDEMNATION OR GRANT).
For primary bibliographic entry see Field 06E.
W71-02410

BUSH V CITY OF ROCHESTER (LIABILITY FOR EXPULSION OF SURFACE WATERS UPON LAND OF ANOTHER BY CONSTRUCTION OF A ROAD).
For primary bibliographic entry see Field 06E.
W71-02412

FENNEMA V NOLIN (CONSTRUCTION OF DITCH JUSTIFIED WHERE DISCHARGE OF WATER WAS ABOUT SAME AS UNDER THE NATURAL COURSE OF SAID DITCH).
For primary bibliographic entry see Field 06E.
W71-02413

BEECHLEY V HARMS (INJUNCTION AGAINST INTERFERENCE WITH NATURAL DRAINAGE).
For primary bibliographic entry see Field 06E.
W71-02416

ALLIANCE MILLS CO V SOCIETY FOR ESTABLISHING USEFUL MANUFACTURES (GRANTS OF FLOWAGE RIGHTS).
For primary bibliographic entry see Field 06E.
W71-02418

MAYLENDER V FULTON COUNTY GAS AND ELEC CO (LIABILITY FOR OBSTRUCTION OF NATURAL FLOW).
For primary bibliographic entry see Field 06E.
W71-02420

LOWE V INDIANA HYDROELECTRIC POWER CO (CONDEMNATION POWER OF ELECTRIC UTILITY).
For primary bibliographic entry see Field 06E.
W71-02421

KLEINBERG V RATETT (CONDUIT CARRYING NATURAL STREAM UNDER PROPERTY DOES NOT CONSTITUTE ENCUMBRANCE AGAINST TITLE).
For primary bibliographic entry see Field 06E.
W71-02423

POTAMOLOGY DATA COLLECTION ON LOWER MISSISSIPPI RIVER,
Army Engineer District, Vicksburg, Miss. River Stabilization Branch.
For primary bibliographic entry see Field 02E.
W71-02438

FLOOD PLAIN INFORMATION, FLOOD HAZARD REPORT OF 4-7 JULY 1969 FLOOD, BLACK RIVER, OHIO.
Corps of Engineers, Buffalo, N.Y.

Corps of Engineers Flood Plain Report, May 1970. 9 p, 6 fig, 12 plate, 2 tab.

Descriptors: *Floods, *Flood damage, *Historic flood, Flood plains, Ohio, Flood control, Nonstructural alternatives, Flood protection.
Identifiers: Black River (Ohio), Flood-hazard report.

This flood hazard report presents information specifically for the historical July 1969 flood, including the flooded area map and water surface profiles. Precipitation gages in the Black River watershed show that more than 4 in of rain fell in a 24-hr period with an average intensity of 0.17 in per hr, an occurence interval of once in 50 yr. The USGS water stage recorder below the confluence of East and West branches of the river was washed away, having been in operation since 1944. Industrial plants and Elyria City were damaged by high water and debris. Major floods have occurred along this river in the following decreasing order of magnitude: March 1913, January 1959, May 1956, February 1959, and June 1937. Maps, profiles, photographs and other data are given which will be beneficial for planning and development by State and local governments. (Lang-USGS)
W71-02447

FLOOD PLAIN INFORMATION, DESTIN COASTAL AREA, OKALOOSA COUNTY, FLORIDA.
Corps of Engineers, Mobile, Ala.

Corps of Engineers Flood Plain Report, June 1970. 19 p, 4 fig, 9 plate, 1 tab.

Descriptors: *Hurricanes, *Flooding, *Tidal waters, *Wind tides, Flood damage, Beaches, Gulf of Mexico, Florida, Historic flood, Flood forecasting.
Identifiers: *Flood tides, Intermediate regional flood.

Tidal flooding along the northern coast of the Gulf of Mexico near Destin, Florida is described to aid local agencies with factual bases for reducing future damages and hazards through planning better utilization of areas subject to flooding. Basic data used in preparation of the report include historical flood heights, hurricane pressure, radius and speed, tide records, and flood damage records. The greatest known flood tide at Destin occurred during the hurricane of September 20, 1926 and was 10 to 12 ft above msl on the beach. Other hurricanes causing lesser flood tides occurred in September 1906, July 1936, August 1950, and September 1956. Maximum winds range from 75 to over 200 mph (the strongest was during Camille in August 1969). The 1926 hurricane at Destin had winds up to about 150 mph. (Lang-USGS)
W71-02453

FLOOD PLAIN INFORMATION, YAKIMA-UNION GAP, WASHINGTON.
Corps of Engineers, Seattle, Wash.

Corps of Engineers Flood Plain Report, May 1970. 57 p, 22 fig, 17 plate, 15 tab.

Descriptors: *Floods, *Flood damage, *Washington, Flood plains, Regional flood, Flood forecasting, Flood control, Historic flood.
Identifiers: *Flood records, *Yakima River, Naches River, Stnadard project flood, Intermediate regional flood.

Flooding along the Yakima and Naches Rivers near the cities of Yakima and Union Gap, Washington is described to aid in solving local flood problems and in planning the best utilization of flood-prone lands. Maps, profiles, cross sections, and test material relating the extent of past flooding to floods which might occur in the future are based on available records of rainfall runoff, historical flood heights and other technical data. The December 1933 flood is the largest known on Yakima River and had a peak stage of 15 ft at Parker. An intermediate regional flood has a 1% chance of being equalled or exceeded annually, and maximum flow would be about 70,000 cfs at Parker, while the standard project flood has a peak discharge of 180,000 cfs in the Yakima reach studied. Water velocities vary widely at different places on the floodplain, and flood duration may be for a month. (Woodard-USGS)
W71-02456

FLOOD PLAIN INFORMATION, LITTLE WEKIVA RIVER, SEMINOLE COUNTY, FLORIDA.
Corps of Engineers, Jacksonville, Fla.

Corps of Engineers Flood Plain Report, September 1970. 31 p, 7 fig, 9 plate, 6 tab.

Descriptors: *Floods, *Flood damage, *Florida, Flood plains, Regional flood, Flood forecasting, Flood control, Hurricane.
Identifiers: *Seminole County (Fla), Standard project flood, Intermediate regional flood.

Flooding along Little Wekiva River in western Seminole County, Florida is described to aid in solving local flood problems and in planning the best utilization of flood-prone lands. Maps, profiles, cross sections, and test material relating the extent of past flooding to floods which might occur in the future are based on available records of rainfall, runoff, historical flood heights and other technical data. Velocities of water during the Intermediate Regional Flood would range up to 7.3 feet per second (5 miles per hour) in the channel of Little Wekiva River. During the Standard Project Flood channel velocities of up to 7.8 feet per second can be expected. Velocities in the flood plain for both Intermediate Regional and Standard Project Floods would vary widely, but would generally be less than 2.2 feet per second. The scheduled construction of the new culverts at S.R. 436 will increase velocities in the channel by 0.7 foot per second and in the flood plain by 0.2 foot per second. Velocities greater than 3 feet per second combined with depths of 3 feet or more are generally considered hazardous. (Woodard-USGS)
W71-02457

LOCATING AND TRACING SEEPAGE WATER IN UNSTABLE SLOPES,
Kentucky Dept. of Highways, Lexington. Div. of Research.
Y. A. Alkhoja, and G. D. Scott.
Final Report, February 20, 1970. 37 p. HPR - Kyhpr 63-16.

Descriptors: *Seepage, *Tracers, *Groundwater, *Locating, Slope Stability, Landfills, Fluorescence, Ultraviolet Radiation, Water table, Resistivity, Moisture content, Drilling, Percolation, Dye releases.

A practical method of locating and tracing seepage water in unstable slopes is needed. The study consisted of testing several methods at sidehill fill locations where the highway was distressed. In each case, construction of the fill had blocked drainage. The results of the study indicate the following: (1) Clean, fine sand did not remove fluorescent dye from solution for moderate percolation distances, but the dye became somewhat less detectable due to its absorption by the sand for longer percolation distances. The conventional monitoring equipment (ultraviolet light) was not sufficiently efficient to monitor low concentrations of the dye. The tracer method was not dependable for the purpose of locating seepage waters and was shown to require further improvement. However, it was used to verify a suspected source of seepage when the ground water was believed to have traveled through defined channels or very porous material, (2) The water table observation method was the most definitive and useful of the methods studied for tracing and locating seepage water, (3) The electrical resistivity method did not yield very accurate and dependable results without correlation with actual site moisture conditions, and (4) With more and better selection of sampling holes and resistivity observations, more useful results could be obtained from this method. Since the resistivity results show fair correlations with actual moisture conditions, it is concluded that this method could be used as a preliminary guide as to where drilling should be performed, and possibly to extend relative moisture content data to areas inaccessible to drilling equipment.
W71-02522

PERFORMANCE OF AN ASPHALT TREATED DRAINAGE BLANKET IN A FLEXIBLE PAVEMENT SECTION,
California State Div. of Highways, Sacramento.
T. Smith, R. Forsyth, and W. Gray.
Interim Report M and R No 632618, December 1969. 37 p. 4830213 70.

Descriptors: *Subsurface drainage, *Drainage systems, *Asphalt, *Roads, Filters, Stabilization, Highways.
Identifiers: *Drainage blankets.

Results are presented of a field evaluation of a two-layer highway drainage system on Road 299 between Arcata and Willow Creek in the Northern Coastal Region of California. The experimental section consisted of 400 feet utilizing a two-layer drainage blanket, the top, or drainage element, which was stabilized with asphalt, and 200 feet of normal single-layer drainage blanket serving as a control. The section was located in a cut section with numerous springs and seeps in a high rainfall areas Data from field permeability tests indicated that the drainage capacity of the two-layer system was 3 to 9 times that of the standard underdrain section, while theory indicated a 24 to 1 ratio. Through an unusually wet winter and spring, both sections effectively drained all subsurface water at

the site. Only minor difficulties were encountered in the construction of the two-layer system which could probably have been eliminated by a modification in the grading of the filter element.
W71-02523

STUDY OF EROSION IN ROADSIDE DRAINAGE CHANNELS IN NORTH CAROLINA,
North Carolina State Univ., Raleigh. School of Engineering.
Michael Amein, and H. L. Chu.
Final Report ERD-110-68-4, Appendix, September 1969. 63 p.

Descriptors: *Erosion control, *Roads, *Drainage systems, Design, Channels, *Soil erosion, *Surface drainage, Highways.
Identifiers: *Roadside.

An extensive field study of the performance of roadside drainage channels in North Carolina against the action of erosive forces was conducted. From the results of field observations and measurements, a criteria for the design of stable roadside channels was developed. The report presents three methods of determining whether a triangular shaped roadside drainage channel will be stable if it is fully grassed, partially grassed or bare earth when the discharge to be carried, the slope of the channel bottom, the side slope of the channel, and the soil characteristics of the channel are known. (See also W70-09455)
W71-02525

WINCHESTER V BYERS (LIABILITY FOR ALTERING NATURAL FLOW OF SURFACE DRAINAGE).
For primary bibliographic entry see Field 06E.
W71-02527

MARKLE V GROTHE (COLLECTION AND DISCHARGE OF SURFACE WATER).
For primary bibliographic entry see Field 06E.
W71-02529

DICKINSON V NEW ENGLAND POWER CO (RELATIVE RIGHTS OF DAM OWNER AND LANDOWNER).
For primary bibliographic entry see Field 06E.
W71-02530

TERRITORY OF HAWAII V GAY (RIGHT TO DIVERT WATERS BY OWNER OF LAND AT RIVER'S SOURCE).
For primary bibliographic entry see Field 06E.
W71-02535

UNITED STATES V TUJUNGA WATER AND POWER CO (FORFEITURE OF RIGHTS TO PUBLIC LANDS BY FAILURE TO MEET CONDITIONS OF A GRANT).
For primary bibliographic entry see Field 06E.
W71-02536

CITY OF GOLD HILL V CALIFORNIA-OREGON POWER CO (ACQUISITION OF PRESCRIPTIVE RIGHT TO CONSTRUCT DAM).
For primary bibliographic entry see Field 06E.
W71-02538

WRIGHT V CITY OF RICHMOND (CITY'S LIABILITY FOR FLOODING CAUSED BY INADEQUATE CULVERT).
For primary bibliographic entry see Field 06E.
W71-02540

CITY OF PORTSMOUTH V WEISS CITY'S LIABILITY FOR FLOOD DAMAGE CAUSED BY DAM WASHOUT).
For primary bibliographic entry see Field 06E.
W71-02542

HARRIS MOTOR CO V PULASKI FURNITURE CO (LIABILITY FOR DAMAGE CAUSED BY REPULSION OF SURFACE WATER BY CONSTRUCTION OF BUILDING).
For primary bibliographic entry see Field 06E.
W71-02543

RHINES V COMMISSIONERS OF CHATHAM COUNTY (COUNTY'S LIABILITY FOR OVERFLOWING LAND).
For primary bibliographic entry see Field 06E.
W71-02546

WHITTINGTON V CITY OF BEDFORD (LIABILITY FOR FLOOD DAMAGES CAUSED BY DAM CONSTRUCTION),
For primary bibliographic entry see Field 06E.
W71-02547

LYNCH V MINNESOTA POWER AND LIGHT CO (MEASURE OF DAMAGES FOR FLOOD INJURY TO FARMLAND).
For primary bibliographic entry see Field 06E.
W71-02549

HENRY V CHICAGO, B AND O RR (PROXIMATE CAUSE OF FLOOD DAMAGE).
For primary bibliographic entry see Field 06E.
W71-02553

BOARD OF ROAD COMM'RS V MARKLEY (LIABILITY FOR DAMAGES FROM NEGLIGENT DAM CONSTRUCTION).
For primary bibliographic entry see Field 06E.
W71-02556

WILLIE V MINNESOTA POWER AND LIGHT CO (LIABILITY FOR FLOOD DAMAGE FROM NEGLIGENT DAM OPERATION).

250 NW 809-812 (Minn 1933).

Descriptors: *Minnesota, *Flood damage, *Remedies, Operation and maintenance, Floods, Flooding, Dam design, Excessive precipitation, Reservoirs, Operations, Damages, Water injury, Crops, Adjudication procedure, Judicial decisions, Legal aspects, Floodgates.

Plaintiff landowner brought an action to recover for damages done to his crops caused by defendant power company's negligent operation of a dam. Following an extremely heavy rainfall, the dam developed severe breaks, and it became necessary to open the floodgate while repairs were made, thus allowing the impounded water to flow from the reservoir and flood plaintiff's land. Defendant argued that the allegations were insufficient to establish a case of negligence. The Supreme Court of Minnesota, affirming a judgment for plaintiff, ruled that either of two theories of negligence would be sufficient to have such a case determined by a jury: (1) the doctrine of res ipsa loguitur, and (2) the theory that while an owner of a dam is not an insuror of its safety, he still must exercise care commensurate with any danger which might reasonable stem from the operation of the dam. (Barker-Florida)
W71-02558

COLUMBUS AND GREENVILLE RY V TAYLOR (RIGHT OF RAILROAD TO OBSTRUCT SURFACE DRAINAGE).
For primary bibliographic entry see Field 06E.
W71-02560

KILLGORE V COLE (LIABILITY FOR OBSTRUCTION TO FLOW OF STREAM).
For primary bibliographic entry see Field 06E.
W71-02563

CITY OF MOBILE V LARTIGUE (SERVIENT LAND MUST ACCEPT ONLY WATER FLOWING NATURALLY THERETO FROM DOMINENT ESTATE).
For primary bibliographic entry see Field 06E.
W71-02564

LAW V GULF STATES STEEL CO (LIABILITY FOR OBSTRUCTION OF NATURAL FLOW OF EXCESS WATER IN STREAM).
For primary bibliographic entry see Field 06E.
W71-02568

CRESSON V LOUISVILLE AND N RR (LIABILITY FOR COLLECTION AND DISCHARGE OF DRAINAGE WATER IN EXCESSIVE VOLUME).
For primary bibliographic entry see Field 06E.
W71-02571

SEABOARD ALL FLORIDA RY V UNDERHILL (INJUNCTIVE RELIEF FOR FLOODING BY OBSTRUCTION OF NATURAL DRAINAGE).
For primary bibliographic entry see Field 06E.
W71-02572

BOLINGER V MURRAY (LIABILITY FOR LEVEE WHICH OBSTRUCTED NATURAL FLOW).
For primary bibliographic entry see Field 06E.
W71-02573

LITTLE FALLS FIBRE CO V HENRY FORD AND SONS (LIABILITY FOR MAINTAINING FLASHBOARDS FOR PRIVATE BENEFIT ON A FEDERAL DAM).
For primary bibliographic entry see Field 06E.
W71-02581

CLEVELAND, C C AND ST L RY V MUMFORD (CONSTRUCTION OF LEVEES).
For primary bibliographic entry see Field 06E.
W71-02592

LOUISVILLE AND N RR V O'FLYNN (LIABILITY FOR CROP DAMAGE CAUSED BY OVERFLOW OF DRAINAGE DITCHES).
For primary bibliographic entry see Field 06E.
W71-02597

MERCER COUNTY, NEW JERSEY, COMPREHENSIVE PLAN: STORM WATER RUNOFF AND DRAINAGE FACILITIES.
Mercer County Planning Board, Trenton, N.J.

Available from Ntis as PB-193 993, $3.00 in paper copy, $0.95 in microfiche. Final Report No 6, September 1969. 30 p, 5 tab, 10 ref. HUD Project NJ P-96.
Identifiers: *Regional planning, *New Jersey, *Drainage, Regional planning, *Runoff, Rainfall, Culverts, Bridges (Structures), Surveys, Factor analysis, Statistical data, Storm drainage, Storm water, *Mercer County (NJ).

Major problems occur in developing areas when open land which formerly absorbed rain water becomes covered with structures and asphalt. The county has a major responsibility in ensuring that, as land becomes developed and storm water runoffs increase, facilities guiding flows under county roads remain adequate to handle the increased water flow. The report analyzes each of the drainage areas adjacent to existing major county bridges or culverts to determine whether they will be adequate to handle increased flows when the drainage areas develop as presently zoned.
W71-02602

OPPORTUNITIES AND RESPONSIBILITIES OF LOCAL GOVERNMENT,
Urban Renewal Board, Waterloo, Iowa.
For primary bibliographic entry see Field 06F.
W71-02650

OPEN SPACE PROGRAM OPPORTUNITY IN LAND MANAGEMENT,
National Capital Park and Planning Commission, Washington, D.C.
For primary bibliographic entry see Field 06F.
W71-02656

COMPREHENSIVE FLOOD PLAIN DEVELOPMENT WITH TVA,
Tennessee Valley Authority, Knoxville.
For primary bibliographic entry see Field 06F.
W71-02657

SCS PROGRAMS IN URBAN AND RURAL DEVELOPMENT,
Soil Conservation Service, Beltsville, Md.
For primary bibliographic entry see Field 06F.
W71-02663

PEARCE V SCOTT (OBSTRUCTION OF NATURAL FLOW OF DRAINAGE FROM DOMINANT LAND).
For primary bibliographic entry see Field 06E.
W71-02684

4B. Groundwater Management

THE STUDY OF COLLECTOR WELLS BY MEANS OF VISCOUS FLOW ANALOGY,
Technical Univ. of Istanbul (Turkey). Dept. of Hydraulics and Water Power.
For primary bibliographic entry see Field 08B.
W71-02266

COMBATTING SALT-WATER ENCROACHMENT INTO THE BISCAYE AQUIFER--MIAMI, FLORIDA AREA,
Dade County Public Works Department, Miami, Florida.
F. D. Ronald Park.
Presented at Ltd Professional Symposium on Salt Water Encroachment Into Aquifers, May 4-5, 1967, Louisiana State University. Copies of report available from LSU Bookstore, $5.00. In: 'Salt Water Encroachment Into Aquifers', Bulletin 3, Louisana Water Resources Research Institute, Louisiana State University, Baton Rouge, October 1968. 73 p, 27 fig, 2 tab, 16 ref.

Descriptors: *Encroachment, *Aquifers, *Water quality, *Groundwater, *Water management, *Water supply, Dams, Canal seepage, Leakage, Fresh water, Potable water, Florida.
Identifiers: *Miami (Florida).

The fresh water supply serving the people of the Miami, Florida area is pumped from the Biscayne Aquifer which covers about 3,000 square miles of Dade and Broward Counties and penetrates about 40 miles inland from the Atlantic Ocean and Biscayne Bay. The aquifer is wedge-shaped in elevation, with the base averaging 100 feet below sea level along the coast and rising gradually to zero elevation at its western extremity. The aquifer leaks along its sides. Subsequent to the drainage of the Everglades in 1904, salt water has encroached as far inland as six miles. Programs of Dade County, the Central and Southern Florida Flood Control District, and the U. S. Corps of Engineers have generally stabilized the salt front. Dams are employed in the area's canals to prevent salt water encroachment; however, where the dams are located far inland, to facilitate navigation, encroachment continues. Dams are of two main types: (1) steel piling cut-offs, with removal sections for facilitating large outflows; and (2) automatic vertical-lift gates. The paper describes the problems encountered and the measures implemented in Dade County's 20-year program of combatting salt water encroachment. Legal questions and the effects of the program on water supply, pollution, navigation, land use, subdivision development and people are discussed. (Poertner)
W71-02283

WILLARD V STONE (EASEMENT FOR WATER SUPPLY MEANS REASONABLE USE OF ALL WATER ON SERVIENT PROPERTY).
For primary bibliographic entry see Field 06E.
W71-02329

DAVISON V CITY OF ANN ARBOR (FAILURE OF PROOF THAT LOWERING OF WATER TABLE WAS DUE TO OTHER THAN NATURAL CAUSES).
For primary bibliographic entry see Field 06E.
W71-02378

DEEP WELL DISPOSAL STUDY FOR BALDWIN, ESCAMBIA AND MOBILE COUNTIES, ALABAMA,
Alabama Geological Survey, University.
For primary bibliographic entry see Field 05E.
W71-02428

HYDRAULIC TESTS IN HOLE UA-1 AND WATER INFLOW INTO AN UNDERGROUND CHAMBER, AMCHITKA ISLAND, ALASKA,
Geological Survey, Denver, Colo.
Wilbur C. Ballance.
Geological Survey Open-file Report (Ref Amchitka-21, USGS-474-72), October 1970. 54 p, 37 fig, 1 tab, 4 ref. USAEC Contract AT (29-2)-474.

Descriptors: *Groundwater movement, *Hydraulic gradient, *Drill holes, *Inflow, Aquifers, Mining, Injection wells, Equations, Test procedures, Water levels, Transmissivity, Hydraulic conductivity, Velocity, Storage capacity.
Identifiers: *Underground chamber, Swabbing recovery test.

Hole UA-1, Amchitka Island, was center punched from 1,524.0 to 1,981.2 meters and hydraulically tested to determine an ideal location for mining a chamber. Fifteen zones were tested. Minor amounts of water bypassed the packers during five of the tests. The tested intervals ranged in length from 37.5 to 211.5 meters. For purposes of comparison, relative specific capacities were calculated from comparable 60.4-meter intervals of tested rock, and ranged from 0.1162 to 0.0039 cubic meters per day per meter of drawdown. The interval, 1,745.0 to 1,836.4 meters, appears to be the best location for mining a chamber so far as water inflow is concerned. This interval, 91.4 meters, consists of about 27.4 meters of breccia and 64.0 meters of basalt. The inflow to a spherical chamber 18.3 meters in diameter placed in the center of the proposed 91.4-meter interval, was calculated to be about 175 cubic meters per day after the first day and would stabilize at about 57 cubic meters per day after about 200 days. (Woodard-USGS)
W71-02429

THE ROCK AND BONG TECHNIQUES OF MEASURING WATER LEVELS IN WELLS,
Missouri Univ., Rolla. Dept. of Geology and Geophysics.
For primary bibliographic entry see Field 07B.
W71-02445

SOME LIMITATIONS OF SEISMIC REFRACTION METHODS IN GEOHYDROLOGICAL SURVEYS OF DEEP ALLUVIAL BASINS,
Agricultural Research Service, Tucson, Ariz. Southwest Watershed Research Center.
For primary bibliographic entry see Field 02F.
W71-02446

FACTORS CONTRIBUTING TO UNUSUALLY LOW RUNOFF DURING THE PERIOD 1962-68 IN THE CONCHO RIVER BASIN, TEXAS,
Geological Survey, Austin, Tex.
For primary bibliographic entry see Field 02E.
W71-02448

GROUNDWATER AVAILABILITY IN FORD COUNTY,
Illinois State Water Survey, Urbana.
For primary bibliographic entry see Field 02F.
W71-02449

GEOLOGY AND GROUNDWATER RESOURCES OF LINN COUNTY, IOWA,
Geological Survey, Iowa City, Iowa.
For primary bibliographic entry see Field 02F.
W71-02450

DIGITAL SIMULATION OF THE OGALLALA AQUIFER IN SHERMAN COUNTY, KANSAS,
Kansas State Geological Survey, Colby.
For primary bibliographic entry see Field 02F.
W71-02454

GROUNDWATER IN MONTANA,
Montana Bureau of Mines and Geology, Butte.
For primary bibliographic entry see Field 02F.
W71-02468

4C. Effects on Water of Man's Non-Water Activities

A MODEL RELATING WATER QUALITY, VEGETATIONAL STRUCTURE AND URBANIZATION IN THE SAN JACINTO RIVER BASIN,
Houston Univ., Tex. Dept. of Biology.
For primary bibliographic entry see Field 05G.
W71-02271

SOUTHERN RY V THACKER (LIABILITY FOR OBSTRUCTING PROPERTY'S NATURAL DRAINAGE).
For primary bibliographic entry see Field 06E.
W71-02321

HUMPHRIES V BLACK BETSEY CONSOL COAL CO (LIABILITY FOR FLOOD DAMAGES DUE TO DIVERSION OF STREAM).
For primary bibliographic entry see Field 06E.
W71-02322

DAVIS V GULF AND I RY OF TEXAS (SHALLOW AND CROOKED STREAM NOT NAVIGABLE WATERWAY).
For primary bibliographic entry see Field 06E.
W71-02325

OZARK PIPE LINE CORP V DECKER (LIABILITY FOR STREAM CONTAMINATION BY OIL).
For primary bibliographic entry see Field 06E.
W71-02326

WABASH RR V LEWIS (LIABILITY FOR FLOODING CAUSED BY INSUFFICIENT DRAINAGE THROUGH RAILROAD EMBANKMENT).
For primary bibliographic entry see Field 06E.
W71-02328

NORFOLK AND W RY V MCCOY (LIABILITY OF RAILROAD FOR RIVERFILL CAUSING OVERFLOW).
For primary bibliographic entry see Field 06E.
W71-02330

HORTON V NIAGARA, LOCKPORT AND ONTARIO POWER CO (OWNER OF BANK OWNS TO THREAD OF CHANNEL).
For primary bibliographic entry see Field 06E.
W71-02331

CENTRAL OF GEORGIA RY V FAULKNER (LIABILITY FOR CHANGE IN EXISTING DRAINAGE PATTERN).
For primary bibliographic entry see Field 06E.
W71-02337

VAN CORTLANDT V NEW YORK CENT RR (PRIVATE RIGHT TO RELIEF FROM PUBLIC NUISANCE).
For primary bibliographic entry see Field 06E.
W71-02343

FREED V MIAMI BEACH PIER CORP (INFRINGEMENT OF OCEANFRONT RIGHTS).
For primary bibliographic entry see Field 06E.
W71-02344

ATLANTIC COAST LINE RR V HENDRY (LIABILITY OF RAILROAD FOR FAILURE TO PROVIDE DRAINAGE UNDER TRACKS).
For primary bibliographic entry see Field 06E.
W71-02351

THE KARD (DAMAGES TO BARGE CAUSED BY RAILROAD'S DRAWBRIDGE OVER NAVIGABLE WATERS).
For primary bibliographic entry see Field 06E.
W71-02352

VAN CORTLANDT V NEW YORK CENT RR (BRIDGE OBSTRUCTING NAVIGABLE STREAM NOT ENJOINED WHERE NO DAMAGE SHOWN).
For primary bibliographic entry see Field 06E.
W71-02356

KENTUCKY ELEC DEV CO'S RECEIVER V WELLS (LIABILITY FOR DAMAGE CAUSED BY DAM MAINTAINED AT UNAUTHORIZED HEIGHT DURING UNPRECEDENTED FLOOD).
For primary bibliographic entry see Field 06E.
W71-02370

FORKNER V CHESAPEAKE AND O RY (RESTORATION OF NATURAL DRAINAGE COURSE BY CULVERT).
For primary bibliographic entry see Field 06E.
W71-02396

REUGSEGGER V CHIGAGO GREAT WESTERN RR (LIABILITY FOR FLOODING CAUSED BY OBSTRUCTION OF A STREAM).
For primary bibliographic entry see Field 06E.
W71-02397

YOUNG V ILLINOIS CENT RR (RAILROAD EMBANKMENT ALLEGED TO HAVE OBSTRUCTED NATURAL DRAINAGE, CAUSING FLOOD DAMAGE).
For primary bibliographic entry see Field 06E.
W71-02402

HUTCHINGS V WABASH RY (UPSTREAM OWNER'S DIVERSION OF WATERCOURSE).
For primary bibliographic entry see Field 04A.
W71-02406

CARETTI V BRORING BLDG CO (LIABILITY FOR POLLUTION OF STREAM).
For primary bibliographic entry see Field 06E.
W71-02424

STREAM SEDIMENT: AN ENVIRONMENTAL PROBLEM,
Geological Survey, Fort Collins, Colo.
Harold P. Guy, and George E. Ferguson.
Journal of Soil and Water Conservation, Vol 25, No 6, p 217-221, November-December 1970. 5 p, 2 fig, 3 tab, 19 ref.

Descriptors: *Sedimentation, *Erosion, *Urbanization, *Erosion control, Storm runoff, Accelerated erosion, Soil erosion, Sediment yield, Provenance, Land use, Floods, Land management.
Identifiers: *Urban erosion, *Construction-site erosion.

Urban erosion involves construction sites that tend to be widely dispersed. Unlike the continuing erosion on poorly managed agricultural lands, construction sites erode mainly during the brief periods between land clearing and stabilization of the new surface. In Scott Run, a 4.54-square-mile watershed near Washington, D.C., highway construction affected about 11% of the watershed from 1961 to 1964. Measurements of 88 storm events showed that 37% of the runoff and 99% of the sediment movement occurred in 3% of the time, and that highway construction areas, 1 to 10% of the basin, contributed 85% of the sediment. Erosion was about 10 times that normally expected from cultivated land, 200 times that expected from grassland and 2,000 times that expected from forest land. Sediment transport in storm runoff was measured for 25 storm events from a 58-acre watershed in Kensington, Md., between July 1959 and January 1962. During this period, 89 single-dwelling houses were constructed on 20 1/2 acres in the upper part of the watershed. An average of 189 tons of sediment per acre was lost from the area. (Knapp-USGS)
W71-02443

EFFECTS OF LAND MANAGEMENT ON QUANTITY AND QUALITY OF AVAILABLE WATER,
New South Wales Univ., Kensington (Australia). Water Research Lab.
Walter C. Boughton.
Australian Water Resources Council Research Report No 120, May 1970. 330 p, 1092 ref. AWRC Project 68/2.

Descriptors: *Land management, *Impaired water quality, *Bibliographies, *Reviews, Erosion, Groundwater movement, Watersheds (Basins), Soil management, Saturated soils, Floods, Water supply, Publications, Runoff, Land use, Vegetation effects, Forecasts.
Identifiers: *Australia, Annotated bibliography, Literature evaluation, Catchment management.

This report results from a project recommended by the Australian Water Resources Council to compile the important sources of water information with emphasis on Australian work but also to search overseas literature largely on principles and methodologies. A centralization of water information is needed for use by authorities in catchment basin management, and is prerequisite for future experimental studies and research. To fulfill the major objectives, an annotated bibliography and a critical evaluation of the literature and current knowledge is presented in this report. A major change that has occurred since settlement of Australia by Europeans is that large areas of native bush have been cleared for pasture or crops with quite apparent effects on the hydrologic cycle. Little precise knowledge is available, but an increase has been noted in total runoff in some stream basins, and the change from trees to grasses and crops has resulted in raising of saline groundwater levels at the foot of slopes and in valleys. Subsequent salting of large areas is evident as water evaporates from the shallow groundwater bodies. Increased erosion has occurred and turbidity levels in streams have risen. The report cites work in progress and needed investigations. Contains 1,092 references distributed under 11 subject chapters. (Lang-USGS)
W71-02452

CANE CREEK COAL MINING CO V BRADEN (DAMAGES CAUSED BY COAL COMPANY'S IMPEDING FLOW OF STREAM).
For primary bibliographic entry see Field 06E.
W71-02686

4D. Watershed Protection

URBAN SOIL EROSION AND SEDIMENT CONTROL,
National Association of Counties Research Foundation, Washington, D.C.
Mel D. Powell, William C. Winter, and William P. Bodwitch.
Available from the NTIS as PB-196 111, $0.95 in microfiche. For sale by the Superintendent of Documents, US Government Printing Office, Washington, D.C. 20402. Price $1.00, Order no I67.13/4:1503 DTL05. Water Pollution Control Research Series 15030 DTL, May 1970. 97 p. FWQA Program 15030 DTL.

Descriptors: Sedimentation, *Soil erosion, *Sediment control, Urban runoff, Watershed management, *Drainage control, *Reviews, *Urbanization, Soil conservation, Legislation, Social aspects, Legal aspects, Water pollution control, Governments, Water law.
Identifiers: *Urban sediment control.

This study was conducted to determine the causes and the extent of urban and suburban soil erosion and sediment problems, and to describe ways in which local communities can organize and implement effective sedimentation control programs. An evaluation is provided on the state-of-the-art of urban sedimentation control, and a series of research needs in the sedimentation field is cited. In addition, this report includes the 'Community Action Guidebook for Soil Erosion and Sediment Control' (See also W70-06574) which describes methods by which local governments can organize, plan, finance, staff, and implement urban sedimentation control programs. Aspects of areawide approaches, legal authority, and public support for sedimentation control are discussed, and an action plan is outlined. It was found that soil erosion and sediment in developing areas is extensive, and that these problems pose significant threats to both soil and water resources. While many of the required technical means for controlling sedimentation problems already exist, new administrative approaches are needed which accomodate the diversity of interests and pressures associated with urban and suburban development. (Winter-NACRF)
W71-02276

TOLER V BEAR CREEK DRAINAGE DIST (AUTHORITY OF DRAINAGE DISTRICT TO DIVERT WATER FROM WATERSHED).
For primary bibliographic entry see Field 06E.
W71-02371

PROCEEDINGS OF THE NATIONAL CONFERENCE ON SEDIMENT CONTROL.
Dept. of Housing and Urban Development, Washington, D.C. Office of Metropolitan Planning and Development.

Proceedings of National Conference on Sediment Control, U.S. Dept. of Housing and Urban Development, Environmental Planning Paper, May 1970. 54 p.

Descriptors: *Sedimentation, *Urbanization, *Cities, *Erosion, Deposition (Sediments), Silting, Legislation, Legal aspects, Regulation, Water pollution sources, Water quality control, Conferences, Reviews.
Identifiers: *Urban sediment control.

The National Conference on Sediment Control was convened in Washington, D.C. on September 14-16, 1969. The purpose was to bring together representatives of state, regional and local agencies to explore ways of combating soil erosion and sedi-

ment problems in urban and suburban areas. A major task of the conference was the development of a final version of a 'Community Action Guidebook for Soil Erosion and Sediment Control'. It is estimated that more than 4,000 acres a day are being plowed up to build real estate developments, suburban facilities, highways and industries. Sediment yields from some of these activities are believed to be 500 times greater than from rural soil erosion, and urban drainage from concrete surfaces provides another substantial source of sediment deposits. Nine papers are printed in the proceedings; they describe pertinent policies and programs aimed at efforts by Federal, State and local officials to obtain more effective sediment controls in urban and suburban areas. (Knapp-USGS)
W71-02425

05. WATER QUALITY MANAGEMENT AND PROTECTION

5A. Identification of Pollutants

WATER GEOCHEMISTRY, HOG CREEK BASIN, CENTRAL TEXAS,
Baylor Univ., Waco, Tex. Dept. of Geology.
Thomas H. Moore.
Available from Dept of Geology, Baylor Univ, Waco, Tex 76703 - Price $1.04. Baylor Geological Studies Bulletin No 18, Baylor University, Spring 1970. 44 p, 52 fig, 1 tab, 35 ref, 3 append.

Descriptors: *Water chemistry, *Hydrologic cycle, *Hydrogeology, *Chemical analysis, *Texas, Geologic investigations, Rainfall, Runoff, Streamflow, Drainage, Infiltration, Groundwater movement, Aquifer characteristics, Spring waters, Geochemistry, Climatic data, Land use, Fertilizers, Soil-water-plant relationships.
Identifiers: Central Texas, Hurst Spring.

This report describes water quality changes in the upper part of Hog Creek basin (48.6 sq mi area), Central Texas, from the time of rainfall on the headwaters until the streamflow reaches Farm Road 217, about 19 mi downstream. Temperature, pH, and dissolved oxygen were measured in the field at 5 sites and various chemical tests were made in the laboratory. Except for brief periods of storm runoff, the creek flow is from springs, principally Hurst Spring. Analyses were made of water samples from each of the major rock formations. The Edwards Limestone, a shallow aquifer, is subject to pollution from agricultural fertilizers as was disclosed by unusually high nitrate concentrations. The highest concentration of dissolved solids and the lowest pH values were in Hurst Spring samples. The average ion concentration was 480 ppm; highest concentrations occurred during dry-weather flow. As the creek flows across formations of different lithologic hcaracter, the chemical character of its water changes in relation to the chemistry of the rocks. (Lang-USGS)
W71-02219

TRITIUM IN STREAMS IN THE UNITED STATES, 1961-1968,
Geological Survey, Wash., D.C.; Weather Bureau, Silver Spring, Md. Office of Hydrology; and Massachusetts Univ., Amherst. Coll. of Agriculture.
For primary bibliographic entry see Field 05B.
W71-02434

AUTOMATE KJELDAHL ANALYSES OF NITROGENOUS MATERIALS IN AQUEOUS SOLUTIONS,
National Inst. for Water Research, Pretoria (South Africa).
For primary bibliographic entry see Field 02K.
W71-02439

DETERMINATION OF PENTACHLOROPHENOL IN ORGANIC TISSUES AND WATER,
Swedish Water and Air Pollution Research Lab, Stockholm.
Lars Rudling.
Water Research, Vol 4, No 8, p 533-537, August 1970. 5 p, 1 fig, 5 tab, 1 ref.

Descriptors: *Pollutant identification, *Chemical analysis, *Chlorinated hydrocarbon pesticides, *Fungicides, Wood preservatives (Pesticides), Gas chromatography, Analytical techniques.
Identifiers: Pentachlorophenol.

A method for the determination of pentachlorophenol (PCP) in tissues and natural waters is described. The PCP is extracted from the acidified sample with n-hexane and then re-extracted into a borax solution. It is then acetylated by extracting with n-hexane containing acetic acid anhydride and pyridine. The resulting pentachlorophenyl acetate is analyzed by gas chromatography using an electron capture detector. The PCP content in fish from a lake into which PCP is discharged is reported. The data obtained indicate that PCP accumulate in aquatic organisms. The identity of the PCP was established by combined gas chromatographic--mass spectrometric analysis. (Knapp-USGS)
W71-02440

WATER RESOURCES DATA FOR COLORADO-1968: PART 2. WATER QUALITY RECORDS.
Geological Survey, Denver, Colo. Water Resources Div.
For primary bibliographic entry see Field 02K.
W71-02470

OIL POLLUTION OF THE OCEAN,
Woods Hole Oceanographic Institution, Mass.
For primary bibliographic entry see Field 05C.
W71-02474

HYDROCARBON POLLUTION OF EDIBLE SHELLFISH BY AN OIL SPILL,
Woods Hole Oceanographic Institution, Mass.
For primary bibliographic entry see Field 05C.
W71-02475

A PREDATOR-PREY RELATIONSHIP. SEA STARS-BIVALVES. THE CHEMICAL BASIS OF THE RESPONSE OF ASTERIAS VULGARIS TO CRASSOSTREA VIRGINICA. A BIOASSAY, ITS APPLICATIONS AND THE PARTIAL PURIFICATION OF AN ACTIVE EXTRACT,
Woods Hole Oceanographic Institution, Mass.
For primary bibliographic entry see Field 05C.
W71-02477

WATER QUALITY STANDARDS FOR TEMPERATURE,
Federal Water Pollution Control Administration, Washington, D.C. Office of Program Planning and Development.
Robert S. Burd.
In: Engineering Aspects of Thermal Pollution, Chapter 3, p 72-77, 1969.

Descriptors: *Standards, *Temperature, Thermal pollution, Water quality, Fish, Environmental effects, Water pollution, Heated water.

Summary of water quality standards approved by FWPCA referring to the temperature and temperature increase caused by thermal discharges are discussed. The water quality standards vary significantly from state to state, both numerical and narrative approaches were used by most states. Numerical criteria were tailored to the type of fishery to be protected. Numerical limits generally referenced a seasonal maximum, allowable change from background temperatures, and occasionally a rate of change. There is felt a necessity of proper definition of mixing zone. The proposals for further research is stated. (See also W71-02478) (Novotny-Vanderbilt)
W71-02480

RESEARCH NEEDS FOR THERMAL POLLUTION CONTROL,
Federal Water Pollution Control Administration, Washington, D.C.
J. Frances Allen.
In: Biological Aspects of Thermal Pollution, Chapter 12, p 382-391, 1969. 11 ref.

Descriptors: *Thermal pollution, *Research and development, *Environmental effects, *Temperature, *Fish, *Fish food organisms, Self-purification, Water pollution, Water quality, Ecology, Food chains, Ecosystems.

Research needs for freshwater, marine, and estuarine life have not been treated separately, for the needs are similar. Knowledge of the organisms occupying any of these environments is so inadequate that it is necessary to have some kind of investigations. Design of such studies would be adapted to meet the unique and diverse conditions of a given situation. Immediate attention should be directed toward the determination of the effects of temperature on reproduction and growth of important fishes, shellfish, or other desired harvestable crop. This should be followed closely by, or simultaneously with, the determination of thermal effects on food-chain organisms. This approach is required for all life-history stages. Research should reduce the lack of knowledge on thermal effects in conjunction with other parameters, particularly on long-term effects, direct and indirect. Effects on other physiological processes, migratory behavior, ecological stability, increased sensitivity to toxicity, susceptibility to disease, and predator-prey relationships must be considered. Long-term effects should be stressed. More definitive work should be focused on temperature effects on the alteration of the environment, including salinity, temperature, current patterns, and chemical exchange. Although much data are available, especially on salinity and current patterns, more refined techniques are required to analyze the implications and interpretations of these data. Definitive surveys must be initiated in areas of temperate, subtropical, and tropical waters, where thermal loading is a distinct possibility. The influence of increased temperatures on the nutrient cycle, with subsequent eutrophications as a strong possibility, should receive due recognition. (See also W71-02491) (Novotny-Vanderbilt)
W71-02498

THE REMOTE SENSING OF OIL SLICKS BY RADAR,
Naval Research Lab., Washington, D.C.
N. W. Guinard, and C. G. Purves.
Available from NTIS as AD-709 982, $3.00 in paper copy, $0.95 in microfiche. April 1970. 10 p. NRL Proj RO7-02.
Identifiers: *Water pollution, Oils, *Radar, Sensors, *Oils, Detection, Airborne, Oil slicks.

The NRL Four frequency Radar System, at Coast Guard request, was flown over the oil slick caused by the wreck of the tanker Arrow in the Chedabucto Bay area of Nova Scotia on 17 February 1970. The oil slick was mapped remotely from an EC-121 aircraft in both the horizontal and vertical polarizations. Synthetic aperature imagery was obtained in the P,X,L and C-band. This data clearly established the value of the radar sensing techniques as a tool for locating and monitoring oil spills.
W71-02615

CARBON MONITOR,
Automated Environmental Systems, Inc.
Frank R. Boucher.
Instruments and Control Systems, Vol 43, No 1, p 22-23, January 1970. 1 fig.

Descriptors: *Carbon, *Organic matter, *Monitoring, *Infrared radiation, Carbon dioxide, Instrumentation.
Identifiers: *Total organic carbon, Infrared analyzer.

A new total organic carbon (TOC) monitor has been developed which provides continuous measurement with no manual pretreatment or manipulation. The instrument consists of a sample feed and pretreatment system, which removes inorganic carbon from the effluent stream; an oxidation system, which converts the organic carbon to carbon dioxide; and an infrared analyzer which measures the carbon dioxide and produces a signal directly proportional to TOC in the stream. The effluent produced by the monitor contains gaseous water, carbon dioxide and oxygen, plus oxidation products of noncarbonaceous compounds. The carbon dioxide in the effluent is proportional to the total organic carbon in the sample stream. (Little-Battelle)
W71-02672

A RAPID, NONDESTRUCTIVE TECHNIQUE FOR INFRARED IDENTIFICATION OF CRUDE OILS BY INTERNAL REFLECTION SPECTROMETRY,
James S. Mattson, Harry B. Mark, Jr., Ronald L. Kolpack, and Clarence E. Schutt.
Analytical Chemistry, Vol 42, No 2, p 234-238, February 1970. 5 fig, 2 tab, 17 ref.

Descriptors: *Oil, *Spectrophotometry, Chemical analysis, Data processing.
Identifiers: *Internal reflection spectrometry, *Crude oil, *Tar, *Santa Barbara channel, Platform A Infrared spectrometry.

A rapid, direct, and qualitative internal reflection spectroscopic (IRS) technique for the identification and differentiation of crude oils and tars is presented. The sample needs no pretreatment and may either be a liquid or mixed with a solid substrate. As IRS is relatively more sensitive than transmission spectroscopy over an extended portion of the infrared, the use of IRS results in a better sample spectrum. The results of this study show that differentiation of crude oil samples originating both from Platform 'A' and from natural seepages in the Santa Barbara Channel is possible, based upon the presence of carbonyl and carbon monoxide-like bands observed only in the natural seepage samples. Representative examples of IRS taken for crude oils are included in the article. A discussion is also included on data treatment. (Little-Battelle)
W71-02673

THE DETERMINATION OF CYANIDE IONS IN WATERS AND EFFLUENTS BY AN AUTO-ANALYZER PROCEDURE,
P. Casapieri, R. Scott, and E. A. Simpson.
Analytica Chimica Acta, Vol 49, p 188-192, January 1970. 1 fig, 4 tab, 7 ref.

Descriptors: *Automation, *Effluents, *Colorimetry, *Waste water (Pollution), *Sewage effluents, Trace elements.
Identifiers: *Auto-Analyzer, *Cyanide, Interference, Aldridge method.

After a review of analytical methods for cyanide determination, the conclusion was reached that the most satisfactory colorimetric procedure is the Aldridge method which is based on the Koenig synthesis. In this procedure, cyanide is brominated to cyanogen bromide, excessive bromine is removed by a reductant, and cyanogen bromide is coupled with pyridine and an aromatic amine to give a colored complex. In order to handle large numbers of samples, this method was adapted for use with the Auto-Analyzer. An important feature of the procedure is the distillation stage, which not only improves the selectivity of the method, but also eliminates the necessity of filtering samples containing particulate matter. The distillation stage is designed to give a sample rate of 40 samples/h. Analysis of 1000 water samples (mostly trade effluents) by manual methods and by using the Auto-Analyzer showed excellent correlation between the results. The range of 0.5 to 10 p.p.m. of cyanide ions was of primary interest, but it was found that Beer's law was obeyed up to 40 p.p.m. of cyanide without any change within the system. Tables are included which show the results of the tests as well as interferences that result from lead, nickel, copper, mercury, cyanate, thiocyanate, thiosulfate, bisulfite, nitrite, hypochlorite, formaldehyde, and phenol ions. (Little-Battelle)
W71-02674

FAST-RESPONSE OXYGEN SENSOR TESTED.

Commercial Fisheries Review, Vol 32, No 2, p 22-23, February 1970. 1 tab.

Descriptors: *Dissolved oxygen, *Dissolved oxygen analyzers, *Sea water, Nansen bottles, Water quality, Water analysis.

Ocean oxygen measurements conducted by a civilian oceanographer of the U. S. Naval Oceanographic Office indicate that a new oxygen sensor may replace the old Nansen bottle method. The new sensor is a one-step method which can provide continuous oxygen measurements while it is being lowered through various ocean depths. The sensor produces an electrical signal which is transmitted up through an oceanographic cable to the ship. A sample chart shows the levels of dissolved oxygen at various steps determined during one of the preliminary tests. (Little-Battelle)
W71-02676

MEASUREMENT AND SIGNIFICANCE OF ADENOSINE TRIPHOSPHATE IN ACTIVATED SLUDGE,
Florida Univ., Gainesville. Dept. of Environmental Engineering.
James W. Patterson, Patrick L. Brezonik, and Hugh D. Putnam.
Environmental Science and Technology, Vol 4, No 7, p 569-575, July 1970. 10 fig, 1 tab, 26 ref.

Descriptors: *Activated sludge, *Biomass, *Metabolism, *Inhibitors, Separation techniques, Spectrometers, Toxicity, Heavy metals, Hydrogen ion concentration, Enzymes.
Identifiers: *Adenosine triphosphate, Luciferin, Luciferase, Mercury, Enzymatic inhibitors.

A method of adenosine triphosphate (ATP) measurement in activated sludge has been developed from the firefly reaction of luciferin and luciferase with ATP, in which light production is proportional to ATP present. The purpose of the measurements was to utilize this parameter as a measure of metabolic activity and/or biomass. The ATP was extracted from the sludge by diluting it with 40 ml of boiling tris buffer and boiling it in a water bath for 10 minutes with occasional shaking. The ATP extracted was mixed with firefly tail extract, and the light emitted was measured by liquid scintillation spectrometer. A number of tests were conducted to determine the effect of temperature of ATP extraction, age and concentration of the reconstituted firefly lantern extract, and the presence of enzymatic inhibitors in the extracted samples. The technique has proved to be sensitive and reliable for quantitative determination of cellular ATP pool. ATP levels in activated sludge are relatively constant under endogenous conditions, indicating the potential of ATP as an estimate of viable biomass and respond rapidly to induced changes in metabolic activity. Advantages of an activity parameter over historically used biomass parameters for activated sludge operation control are manifold; ATP assay holds promise as a sensitive tool for future research on sludge activity in process control. (Little-Battelle)
W71-02677

POLYCHLORINATED BIPHENYLS,
David B. Peakall, and Jeffrey L. Lincer.
BioScience, Vol 20, No 17, p 958-964, September 1, 1970. 1 fig, 2 tab, 62 ref.

Descriptors: *Chlorinated hydrocarbon pesticides, *Food chains, *Pesticide toxicity, Physical properties, Chemical analysis, Persistence, Absorption, DDT, Chemical properties, Plastics, Paints, Rubber, Resins, Gas chromatography, Spectrophotometry, Mallard duck, Poultry, Songbirds, Wading birds, Mussels, Herrings, Path of pollutants, Water pollution sources, Water pollution effects.
Identifiers: *Biological magnification, *Aroclors, *Polychlorinated biphenyls, Chemical structure.

The structural and physical properties, uses, analytical methods, toxicology, levels in nature, and biological magnification of PCBs, and the ratio of DDT to PCB in the environment are summarized. Although nothing is known about the biological decomposition of PCBs, it is likely that they are more stable than DDT and its metabolites and thus have a tendency to accumulate up the food chain. No figures on the amount of these materials produced annually are available. Analysis of PCBs has been carried out by means of a combination of high resolution gas chromatography and mass spectrometry. Nitration and saponification have been used to separate PCBs from other residues for analysis. Although several studies have been carried out on the toxicology of PCBs, toxic levels are still largely undefined. Studies have shown, however, that there are striking alternations in the internal organs of some mammals and birds. Data taken from several studies indicate that the PCBs are capable of biological magnification of the food chain. Because of the apparent danger of these materials it is necessary to discover the major sources of their escape into the environment. Sixty-two references have been cited in this summary. (Little-Battelle)
W71-02678

A HAND-OPERATED WINCH FOR BACTERIOLOGICAL WATER SAMPLING,
Hawaii Univ., Honolulu. Dept. of Microbiology.
For primary bibliographic entry see Field 07B.
W71-02679

SEPARATION OF PHENOLIC COMPOUNDS FROM CARBON CHLOROFORM EXTRACT FOR INDIVIDUAL CHROMATOGRAPHIC IDENTIFICATION AND MEASUREMENT,
James W. Eichelberger, Ronald C. Dressman, and James E. Longbottom.
Environmental Science and Technology, Vol 4, No 7, p 576-578, July 1970. 1 fig, 2 tab, 4 ref.

Descriptors: *Phenols, *Chemical analysis, *Separation techniques, Solvent extractions, Gas chromatography.
Identifiers: *Alkyl phenols, *Chlorophenols, *Aminophenols.

A procedure is presented for efficient isolation of many phenols from carbon chloroform extracts (CCE) prior to chromatographic identification. The phenols, as weak acids, are isolated by a Florisil column cleanup of the CCE. Techniques for evaporation and preparation of the extract are given. Application of the method to grab samples as well as qualitative and quantitative determinations are discussed. Recovery data and relative retention times for a gas-liquid chromatographic separation are reported. (Little-Battelle)
W71-02680

IMPACT OF AGRICULTURAL POLLUTANTS ON WATER USES,
Robert S. Kerr Water Research Center, Ada, Okla.
James P. Law, Jr., and Harold Bernard.
Transactions at the American Society of Agricultural Engineers, Volume 13, No 4, p 474-478, July-August 1970. 3 tab, 23 ref.

Descriptors: *Farm wastes, *Irrigation, *Salinity, *Pollutants, *Fertilizers, *Water pollution sources, Biochemical oxygen demand, Chemical oxygen demand, Disposal, Livestock, Agricultural chemicals, Aquatic life, Water quality, Fish, Dissolved oxygen, Aesthetics, Recreation, Pollutant identification.
Identifiers: *Agricultural pollutants, *Aesthetic value, Total salt, Primary contact recreation, Secondary contact recreation.

This paper discussed the water pollution potential of agricultural sources. Animal wastes, irrigation return flows, fertilizer application, and pesticides are the primary sources of agricultural pollutants. The water-quality criteria for water supplies are discussed as related to agricultural contaminants. Data is presented for the desirable and permissible limits of concentration for the various contaminants. Agricultural is responsible for a major portion of the total salt in many rivers and streams. Data is given for the proposed safe limits of water salinity for livestock. The impact that agricultural pollutants has on fish, other aquatic life, and wildlife is discussed. Examples are cited where pollutants have adversely affected fish and wildlife. Now is the time to build the cost of clean water into all of our operations. (Christenbury-Iowa State)
W71-02687

IDENTIFICATION OF GASES IN A CONFINEMENT SWINE BUILDING ATMOSPHERE,
Iowa State Univ., Ames. Dept. of Agricultural Engineering.
J. A. Merkel, T. E. Hazen, and J. R. Miner.
Transactions of the American Society of Agricultural Engineers, Vol 12, No 3, 1969, p 310-313 and 315. 5 fig, 1 tab, 11 ref.

Descriptors: *Farm wastes, *Hogs, *Odor, *Gases, Confinement pens, Sulfur compounds, Ammonia, Amino acids, Porteins, Carbohydrates, Lipids, Organic acids, Solubility, Hydrogen ion concentration, Chromatography, Alcohols, Sulfides, Salting, Absorption, Condensation, Pollutant identification.
Identifiers: Acid-forming, Methane-producing, Manure storage pit, Amides, Amines, Carbonyls, Esters, Mercaptans.

In addition to the already known fixed gases, CO2, CO, H2S, NH3, CH4, etc., the environment within a confinement swine unit was found to contain a complex mixture of volatile organic intermediates. These intermediates are important in the characteristic odor resulting from the storage of manure and are suspected as being important in animal and building performance. Consideration of physical as well as organic, biochemical phenomena indicated that the important intermediate products of anaerobic manure decomposition include organic acids, amines, amides, alcohols, carbonyls and sulfides. Qualitative chemical analysis confirmed the presence of these homologous groups, except for organic acids that were decomposed upon formation by the high pH maintained within the manure storage pit. To identify individual compounds within the swine environment, concentration of the volatile gases was required. Selective absorption, liquid salting and selective condensation were each used in an effort to separate and concentrate the homologous series. Once separated, the series were subjected to chromatographic analysis for separation and identification. Physiological odor investigations have been conducted to indicate the important compounds in the specific odors in swine buildings. Work to date indicates that the major odor constituents are from the amine and sulfide groups. Further work is under way to separate these compounds. (White-Iowa State)
W71-02692

SEEK DATA IN FEEDLOT RESEARCH.
South Dakota State Univ., Brookings.

South Dakota Farm and Home Research. Vol XXI, No 2, Spring 1970, p 22-27. 2 tab, 8 fig.

Descriptors: *Farm wastes, *South Dakota, *Design criteria, Cattle fertilizers, Biochemical oxygen demand, Water pollution.
Identifiers: *Feedlots, *Farm terraces, Population equivalents, Constituents.

This is a preliminary report of research aimed at coming up with information that can be used by livestock producers, governmental agencies and persons concerned with commercial feedlot design and construction. Some advantageous conditions for feedlot expansion in South Dakota are discussed. Pollution constituents in animal waste and runoff quantities are considered in making some general recommendations as to the design or layout at a feedlot. Six sketches are utilized in presenting some do's and don't's in feedlot design. (Christenbury-Iowa State)
W71-02694

WILSCHWITZ RUNOFF SAMPLER,
Wisconsin Univ., Madison. Dept. of Agricultural Engineering.
S. A. Witzel, J. T. Wilke, and F. L. Schmitz.
Transactions of the American Society of Agricultural Engineers, Vol 11, No 6, 1968, p 883, 886. 3 fig, 1 ref.

Descriptors: *Runoff, *Nutrients, *Sampling, Farm wastes, Weirs, Nitrogen, Phosphorus, Potassium, Water levels, Pollutant identification.
Identifiers: Prediction equations, Wilschwitz sampler, Water stage recorder.

The sampler was developed for the purpose of automatic collection of water samples from the flood runoff of small watersheds. It was intended to be used for measuring plant nutrient contained in runoff and not for determining suspended sediment loads. The installation of the Wilschwitz sampler in conjunction with a weir and water stage recorder provides an inexpensive means of obtaining runoff samples at various stages. The unique feature of the sampler is that it operates without auxiliary power. Details of the sampler's construction and operation are given in the article. Data gathered with this sampler are to be used in developing prediction equations relating the rates and amounts of runoff to the plant nutrients lost. If such correlations can be made, equations may be programmed to estimate amounts of nitrogen, phosphorus, potassium or other elements that may be anticipated in the surface water runoff. (White-Iowa State)
W71-02695

MOISTURE INCREASES MANURE ODORS,
Cornell Univ., Ithaca, N.Y. Dept. of Agricultural Engineering.
D. C. Ludington, and A. T. Sabel.
Poultry Digest, September 1970, p 445-446. 1 fig, 2 tab, 1 pic.

Descriptors: *Farm wastes, *Odors, Air pollution, Poultry, Ammonia, Hydrogen sulfide, Waste dilution, Chromtography, Organic acids, Pollutant identification.
Identifiers: Masking agents, Counteractants, Deodorants, Organoleptic test.

Studies of handling livestock wastes have shown that increased dilution facilitates faster settling of manure solids; thus requiring constant agitation for efficient removal of solids. Despite some apparent handling advantages of diluted animal wastes, other considerations such as lack of odor control, quantity of material to be handled, availability of water for dilution, and certain pollution may combine to preclude handling as liquid waste. Odor strengths of animal manures have been measured using liquid dilution and vapor dilution. Agitation of liquid manure causes odors to be released and their strength to increase rapidly. A combination of gas chromotographic and organoleptic techniques have been used to determine the chemical compounds responsible for the offensive odor of accumulated liquid poultry manure. Organoleptic tests indicate that the organic acids, mercaptans and sulfides are especially important malodorous components, in addition to the odorous gases ammonia and hydrogen sulfide. An organoleptic test was developed for evaluating over 40 commercial odor control products to use with liquid waste. Masking agents and counteractants were found to be the most effective. The better procedure for controlling air pollution is to prevent the formation of odors rather than attempt to control. A manure-handling system that incorporates moisture removal apparently has some merit. (White-Iowa State)
W71-02699

MEASUREMENT OF THE ODOR STRENGTH OF ANIMAL MANURES,
Cornell Univ., Ithaca, N.Y. Dept. of Agricultural Engineering.
A. T. Sobel.
In: Animal Waste Management, Proceedings Cornell University Conference on Agricultural Waste Management, 1969, p 260-270. 6 fig, 4 tab, 10 ref.

Descriptors: *Farm wastes, *Odor, Poultry, Anaerobic conditions, Pollutant identification, Waste water treatment.
Identifiers: *Vapor dilution, *Threshold Odor Number, *Odor Intensity Index, Liquid dilution, Panel, Batch condition, Odor strength, Ranking.

Strength is a characteristic of an odor that can be measured. In contrast to characteristics such as quality and occurrence which rely only on individual opinion, strength allows associating a number with an odor. This can be very valuable for comparing manure handling systems as to odor production. Measurement of odor strength is usually accomplished by determining the magnitude of dilution required so that the odor is just detectable (olfactory threshold). The human nose is utilized as the detector. The application of the measurement of odor strength to animal manures was attempted in the laboratory. The method of liquid dilution and the method of vapor dilution were investigated. Vapor dilution looks at the odors arising from the manure while liquid dilution is concerned with the odors in the manure or the odor potential of the manure. Fifteen conclusions and observations were made as a result of the study. (White-Iowa State)
W71-02733

TYPICAL VARIATIONS ENCOUNTERED IN THE MEASUREMENT OF OXYGEN DEMAND OF ANIMAL WASTES,
Ohio State Univ., Columbus. Dept. of Agricultural Engineering.
E. Paul Taiganides, and Richard K. White.
In: Animal Waste Management, Proceedings Cornell University Conference on Agricultural Waste Management, 1969, p 327-335. 2 tab, 7 fig, 9 ref.

Descriptors: *Farm wastes, *Biochemical oxygen demand, *Oxygen demand, Temperature, Hogs, Cattle, Poultry, Sheep, Pollutant identification, Waste water treatment.
Identifiers: *Warburg, *Sewage Seeding, *BOD oxygen probe, Dilution effects.

Tables and figures were presented to emphasize the inherent variability in the parameters used in measuring oxygen demand. Reliable values of oxygen demand are essential because they are used as design parameters in waste treatment plants. Past and present experiments are being done with large numbers of replicates for each experiment to determine a reliable range of values for the various oxygen demand parameters of animal wastes. BOD was expressed in milligrams of oxygen required per gram of total solid matter (mg O2/g TS) since values reported in ppm or mg/l are useless because of the large variability in solid content of the waste and the high dilutions needed for the BOD test. Three methods of determining the BOD of animal waste were tested. These were the standard test, the BOD oxygen probe and Warburg. Effects of temperature and seeding with sewage were also explored. (White-Iowa State)

W71-02738

5B. Sources of Pollution

COMBATTING SALT-WATER ENCROACHMENT INTO THE BISCAYE AQUIFER--MIAMI, FLORIDA AREA,
Dade County Public Works Department, Miami, Florida.
For primary bibliographic entry see Field 04B.
W71-02283

HARVEY REALTY CO V BOROUGH OF WALLINGFORD (RIPARIAN RIGHTS AND PROTECTION OF PUBLIC WATER SUPPLY).
For primary bibliographic entry see Field 06E.
W71-02314

OZARK PIPE LINE CORP V DECKER (LIABILITY FOR STREAM CONTAMINATION BY OIL).
For primary bibliographic entry see Field 06E.
W71-02326

SMITH V STASO MILLING CO (DOCTRINE OF COMPARATIVE HARDSHIP NOT APPLICABLE WHERE POLLUTER FOREWARNED OF POLLUTION DANGER).
For primary bibliographic entry see Field 06E.
W71-02336

WYNN V WILSON (SEEPAGE FROM IMPROPERLY CAPPED OIL WELL ALLEGED TO HAVE DAMAGED SPRING AND LAND).
For primary bibliographic entry see Field 06E.
W71-02372

LAUMA V BUNKER HILL AND SULLIVAN MINING AND CONCENTRATING CO (EASEMENT TO DUMP WASTES).
For primary bibliographic entry see Field 06E.
W71-02386

A HYDROLOGICAL APPROACH TO CONTROL ACID MINE POLLUTION FOR LAKE HOPE,
Ohio Univ., Athens. Dept. of Geology.
For primary bibliographic entry see Field 05G.
W71-02427

TRITIUM IN STREAMS IN THE UNITED STATES, 1961-1968,
Geological Survey, Wash., D.C.; Weather Bureau, Silver Spring, Md. Office of Hydrology; and Massachusetts Univ., Amherst. Coll. of Agriculture.
T. A. Wyerman, R. K. Farnsworth, and G. L. Stewart.
Radiological Health Data and Reports, Vol 11, No 9, p 421-439, September 1970. 19 p, 2 fig, 20 tab, 10 ref.

Descriptors: *Tritium, *Streams, *United States, Data collections, Analysis, Artificial use, Nuclear explosions, Sampling, Precipitation (Atmospheric), Hydrologic cycle, Streamflow, Flow rates, Rivers, Methodology.
Identifiers: *Artificial tritium input, Tritium concentrations.

As part of its program of water resources investigations, the U. S. Geological Survey has been analyzing the tritium content of stream water since the early 1960's. The results of this sampling program for 20 streams in the conterminous United States and Alaska are tabulated along with relevant stream discharge data. The data show the effect on stream tritium concentration caused principally by thermonuclear detonations, and also seasonal, latitudinal, and continental effects. The Colorado River at Cisco, Utah, and most of the other sampled rivers reached their maximum tritium levels in 1963-1964, whereas the Colorado River near Yuma, Ariz., did not reach its highest level until 1966-1967. About a year after the maximum tritium concentration was reached in the Mississippi River, the concentration in the river at Luling, La., began to approximate about half the concentration near Anoka, Minn. The Yukon River carried the highest concentration derived from precipitation, whereas the Kissimee River had the lowest. Although their basins adjoin, the Potomac River had tritium levels significantly lower than the Ohio River. (Woodard-USGS)
W71-02434

LAKE STRATIFICATION CAUSED BY RUNOFF FROM STREET DEICING,
Wisconsin Univ., Milwaukee. Center for Great Lakes Studies.
John H. Judd.
Water Research, Vol 4, No 8, p 521-532, August 1970. 12 p, 3 fig, 6 tab, 16 ref.

Descriptors: *Density stratification, *Lakes, *Saline water, *Mixing, *Michigan, Water pollution sources, Path of pollutants, Deicers, Melting, Snow removal, Water quailty.
Identifiers: *Street deicing, *Street salting.

Salt is used for winter street deicing throughout most of the northern United States. Much of the salt is dissolved in the melt water and flows into surrounding surface water. Salt entering First Sister Lake, Michigan increased the density of the water in the lower lake strata. During 2 of the 3 yr studied, the increased density prevented complete spring overturn. This can be considered a temporary monomixis. The stability of stratification of the lake was computed. Stability was from 3.5 to 8.5 times greater than when no complete overturn occurred at other times. The lake mixed competely each fall. Laboratory and field tests indicate that salt left the lake and apparently entered the groundwater of the area. Dichtothermic conditions were found in the lake. Density determinations indicated that this was an unstable condition, probably of short duration. (Knapp-USGS)
W71-02441

OIL POLLUTION OF THE OCEAN,
Woods Hole Oceanographic Institution, Mass.
For primary bibliographic entry see Field 05C.
W71-02474

THE COOLING OF RIVERSIDE THERMAL-POWER PLANTS,
Electricite de France, Paris.
Andre Goubet.
In: Engineering Aspects of Thermal Pollution, Chapter 4, p 110-123, 1969. 4 fig, 3 tab.

Descriptors: *Cooling, *Thermal pollution, Thermal power, Heat budget, Heat balance, Temperature, Mixing, Rivers.
Identifiers: France.

Three rivers were investigated in France as to their cooling ability of thermal discharges. For cooling computation, the following formula was used: T sub 2 — T sub 1 exp (-kLx/Q) where T sub 1 and T sub 2 are the excess over the equilibrium temperature in two sections of a canal (or river) a distance of x apart, L is the width of the canal, Q is the rate of flow. Recommended value of k (which may vary with meteorological conditions) is k — .000013. The measurements made in France provided the following major conclusions: (1) the mingling of warm and cold water downstream from a plant is a slow process which takes several kilometers before a nearly homogenous rise is obtained, (2) temperature increase resulting from passage through the condensers is almost always less than 8C. The ways of future research is discussed. (See also W71-02478) (Novotny-Vanderbilt)
W71-02481

DISCUSSION OF 'MECHANICS OF CONDENSER WATER DISCHARGE FROM THERMAL POWER PLANTS' BY D. R. HARLEMAN,
California Inst. of Tech., Pasadena. Dept. of Civil Engineering.
Norman H. Brooks.
In: Engineering Aspects of Thermal Pollution, p 165-172, 1969. 6 fig, 8 ref.

Descriptors: *Water cooling, *Mixing, *Heat transfer, Water pollution sources, Hydraulic design, Outlets, Thermal pollution.

The purpose of this discussion was to point out the possibility of making hydraulic designs for cooling water discharges considering all possible ranges between surface spreading of hot water with minimal mixing and extensive jet mixing of the effluent with the receiving water and with possible storage of waste heat below thermoclines. The different problems in each case are presented and some conclusions are: (a) The alternatives elected in the hydraulic design of outlet structures will certainly depend on the predicted ecological effects of managing the waste heat in different ways. The strong-mixing approach can be expected to be most useful in ocean or in reservoirs and estuaries in which there are substantial currents to carry away the waste heat from the plant site. In small bodies of water, or those without substantial currents, surface spreading will probably be more effective. (b) It is necessary to develop power generation methods which are more efficient and produce less waste heat per unit of power generated. (c) It is recommended to use the metric system of units in all calculations of heat transfer and energy. (See also W71-02478) (Guerrero-Vanderbilt)
W71-02483

MODELING OF HEATED WATER DISCHARGES,
Hydraulic Research Station, Wallingford (England).
Peter Ackers.
In: Engineering Aspects of Thermal Pollution, Chapter 6, p 177-212, 1969. 18 fig, 24 ref.

Descriptors: *Model studies, *Hydraulic similitude, Effluents, Buoyancy, Diffusion, Turbulence, Thermal pollution.
Identifiers: Heat exchange.

The purpose of this paper was to outline some of the more practical aspects of the modeling of buoyant effluents, including a comparison of model and prototype observations in several situations. The main stages of dispersion with their scale relationships are outlined such as jet diffusion, buoyant plume, convective spread, mass transport by ambient currents, ambient turbulence and surface cooling. A comparison between field studies and model results were made in several models: Severn Estuary model, Black Rock outfall/intake model, Power stations and Desalination plant in Hong Kong, Ringsend and Pigeon House Power station in Dublin, Longannet Power Station on the Forth Estuary in Scotland, and proposed 2,400 MW station at Heysham in Lancashire, covering a wide variety of situations. The underlying principles and some of the special equipment used for field surveys at the Hydraulic Research Station, Wallingford, Berks, are presented. Conclusions were: (a) Hydraulic model techniques must be supported by adequate field surveys and its limitations must be realized. Some of the imperfections of modeling are inseparable, but continued research on densimetric and turbulent processes must help to improve the interpretation of scale-model results. (b) The model-prototype comparisons that have been given show that reasonably good agreement is possible, although there remains the problem of the representation of initial mixing zones in vertically exaggerated models. The use of two models, one being a large scale local one of the immediate locality of the outfall, is therefore often advisable. (c) Expenditure in field surveys may form an appreciable proportion of total investigation costs. (d) Infrared techniques are promising in survey methods

in model as well as in prototypes. (See also W71-02478) (Guerrero,Vanderbilt)
W71-02484

DISCUSSION OF 'MODELING OF HEATED DISCHARGES' BY PETER ACKERS,
Tennessee Valley Authority, Norris. Engineering Lab.
Edward E. Driver, and Rex A. Elder.
In: Engineering Aspects of Thermal Pollution, p 213-221, 1969. 3 ref, 2 fig.

Descriptors: *Model studies, *Hydraulic similitude, Outlets, Thermal pollution.
Identifiers: Heat exchange.

A discussion on mass transport by ambient currents and roughness relationship is made and also the simulation of heat exchange with the environment is analyzed, pointing out the implications involved in surface cooling simulation. It is remarked that existing analytic techniques serve to provide a basis for a preliminary estimate of the requirements for a condenser water intake and outlet system; but to insure a proper design, model studies in most cases will be necessary. A brief description of a model study of the condenser water discharge canal for the Cumberland Steam Plant, currently being conducted at the Tennessee Valley Authority's Engineering Laboratory is presented. Three problem areas were identified: (1) The rapidly divergent transition at the upstream end of the discharge canal did not distribute the flow properly, (2) flow separation occurred at the bend, and (3) undesirable mixing occurred near the mouth of the canal. To determine the effect of the transition on the problems, a baffle was installed but it did not alleviate these undesirable conditions. Considerable work remains to be done to determine the best configuration for the discharge canal. (See also W71-02478) (Guerrero-Vanderbilt)
W71-02485

BIOLOGICAL ASPECTS OF THERMAL POLLUTION.
Vanderbilt Univ., Nashville, Tenn. Dept. of Environmental and Water Resources Engineering.
For primary bibliographic entry see Field 05C.
W71-02491

ENGINEERING ASPECTS, SOURCES, AND MAGNITUDE OF THERMAL POLLUTION,
Vanderbilt Univ., Nashville, Tenn. Dept. of Environmental and Water Resources Engineering.
Peter A. Krenkel, and Frank L. Parker.
In: Biological Aspects of Thermal Pollution, Chapter 12, p 10-72, 1969. 28 fig, 5 tab, 32 ref.

Descriptors: *Thermal pollution, Stratification, Water quality, Dissolved oxygen, Iron, Manganese, Power plants, Cooling water, Waste assimilative capacity, Cooling towers, Temperature.
Identifiers: Dry cooling towers.

A general survey is conducted of the engineering aspects of thermal pollution. It describes thermal stratification in impounded waters and the effects of stratification on water quality, discussing in particular the dissolved oxygen balance, iron and manganese, and temperature. The overflow versus completely mixed heated discharges are compared and advantages of each are discussed. Also treated are heat additions from power plants; future cooling water requirements; fluctuating discharges of heated water; effects of heated discharges on waste assimilation; mechanisms for the dissipation of heat; the energy balance and its components; alternative methods for cooling water, such as cooling pond, spray pond, atmospheric towers, hyperbolic towers, mechanical draft towers, and dry cooling towers; the problems with cooling towers, and their cost. Addition of too much heat, either natural or artificial, causes adverse effects on water quality. It will be expensive to cool heated condenser water to its original temperature, but it can be done. (See also W71-02491 and W70-05059) (Rietveld-Vanderbilt)
W71-02492

SINCLAIR REFINING CO V KEISTER (LIABILITY FOR POLLUTION OF WATER SUPPLY BY LEAKAGE OF GASOLINE TANK).
For primary bibliographic entry see Field 06E.
W71-02534

YOUNG V INTERNATIONAL PAPER CO (LIABILITY FOR DESTRUCTION OF GROWING TIMBER BY FLOODING).
For primary bibliographic entry see Field 06E.
W71-02567

A DISPERSION MODEL FOR HEATED EFFLUENT FROM AN OCEAN OUTFALL,
Naval Postgraduate School, Monterey, Calif.
Richard Charles Baldwin.
Available from NTIS as AD-710 730, $3.00 in paper copy, $0.95 in microfiche. Master's Thesis, April 1970. 58 p, 13 fig, 3 tab, 28 ref.
Identifiers: *Sea water, Heat transfer, *Wastes (Industrial), Disposal, *Power plants (Establishments), Heat, Cooling, Two-dimensional flow, Mathematical models, Fluid flow, Surface temperatures, Pacific Ocean, Theses, Heat budget, Heat sinks, *Huntington Beach (Calif), *Thermal pollution.

A mathematical model is developed for dispersion of a heated effluent from an ocean outfall. Input parameters include atmospheric and oceanic conditions and discharge characteristics. The model solves the steady-state, two-dimensional differential equation for non-conservative diffusion of heat in a moving fluid. The solution is calibrated and verified using data from surveys conducted at the Southern California Edison Company power plant at Huntington Beach, California. Temperature fields predicted by the model are compared with the actual fields for seven different surveys. These comparisons indicate that the model can be used to predict the large scale influence of the outfall on the local ocean environment.
W71-02605

POLYCHLORINATED BIPHENYLS,
For primary bibliographic entry see Field 05A.
W71-02678

ENGINEERING ANALYSIS OF CATTLE FEEDLOTS TO REDUCE WATER POLLUTION,
Texas Technological Coll., Lubbock. Dept. of Civil Engineering.
For primary bibliographic entry see Field 05D.
W71-02685

IMPACT OF AGRICULTURAL POLLUTANTS ON WATER USES,
Robert S. Kerr Water Research Center, Ada, Okla.
For primary bibliographic entry see Field 05A.
W71-02687

WILSCHWITZ RUNOFF SAMPLER,
Wisconsin Univ., Madison. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 05A.
W71-02695

SOME CAUSES OF WET POULTRY MANURE,
Georgia Univ., Athens.
O. W. Charles.
Georgia Poultry Tips, August 1, 1970. Poultry Digest, September 1970, p 431.

Descriptors: *Farm wastes, *Poultry, *Moisture content, Water consumption, Strain, Salts, Carbohydrates, Lipids, Proteins, Water pollution sources.
Identifiers: *Ration, Water intake, Uric acid.

Excessive moisture in poultry manure may be due to a number of factors, among which is a tendency for certain strains of birds to produce higher percentage of moisture in the fecal material than other strains. Water represents by far the largest portion of fresh poultry manure. Reports of several researchers are cited as to moisture content and differences in strain. It was found that moisture content of the droppings of low water consuming strains was only 50%, while moisture content of droppings in the high water consuming strain reached 71%. Excessive amounts of salt and a concept of balance in the ration are also discussed as causes of excessive moisture. (White-Iowa State)
W71-02697

ANIMAL WASTE MANAGEMENT.
Cornell Univ., Ithaca, N.Y.
For primary bibliographic entry see Field 05D.
W71-02701

THE NITROGEN PROBLEM IN THE LAND DISPOSAL OF LIQUID MANURE,
Guelph Univ. (Ontario). Dept. of Soil Science.
L. R. Webber, and T. H. Lane.
In: Animal Waste Management, Proceedings Cornell University Conference on Agricultural Waste Management, 1969, p 124-130. 3 tab, 1 fig, 13 ref.

Descriptors: *Farm wastes, *Nitrogen, *Groundwater, Nitrates, Water pollution sources, Waste water treatment.
Identifiers: *Nitrogen pollution, Crop utilization, Pollution control.

Segments of research are presented that lead to the preparation of guidelines outlining the cropland requirements for the utilization and disposal of the nitrogenous compounds in liquid manures. The objective in land spreading was two-fold: (a) to apply the waste at such rates that the practice will be nitrogen utilization for crop production at optimum use-efficiency; and (b) to apply the waste at such rates that the practice becomes primarily one of disposal while not contributing to environmental pollution (air, water, soil). Tables show the different rates of application and how the nitrogen is removed. Recommendations are given as to how much land is required for crop utilization and pollution control for different livestock operations. (White-Iowa State)
W71-02718

WASTE DISPOSAL MANAGEMENT,
Cornell Univ., Ithaca, N.Y.
Charles E. Ostrander.
In: Animal Waste Management, Proceedings Cornell University Conference on Agricultural Waste Management, 1969, p 242-244.

Descriptors: *Farm wastes, Nitrogen, Mortality, Water pollution effects, Incineration, Storage, Odor, Disposal, Water pollution sources.
Identifiers: Compost, Nuisance, Pollution hazard, Residential areas, Neighbors.

The immediate concern of the author was the improvement and the prevention of further destruction of our environment. He spoke of the magnitude of the agricultural waste problem indicating the greatness of the technological and economic aspects. The importance of animal waste as a source of organic nitrogen was pointed out, as were the dangers of inorganic nitrogen. Methods of handling and storage were brought out. The problem of disposing of mortality cases and possible solutions was discussed. Stress was placed on the creation of a favorable image of agriculture in the eyes of the public. (White-Iowa State)
W71-02729

ROLE OF EXCRETED ANTIBIOTIC IN MODIFYING MICROBIAL DECOMPOSITION OF FEEDLOT WASTE,
Colorado State Univ., Fort Collins. Dept. of Microbiology.

S. M. Morrison, D. W. Grant, Sister M. P. Nevins, and Keith Elmund.
In: Animal Waste Management, Proceedings Cornell University Conference on Agricultural Waste Management, 1969, p 336-339. 1 tab, 2 ref.

Descriptors: *Farm wastes, *Antibiotics, Cultures, Cattle, Confinement pens, Biodegradation, Pesticide residues, Assay, Water pollution sources.
Identifiers: *Chlortetracycline, *Biological stabilization, Feedlot, Manure decomposition, Microbial decomposition, In situ manure.

The results presented in this paper are derived from studies on the process of biological stabilization of feedlot manure and the acceleration of the stabilization process. It is a specific study on some microbial inhibitions which may be playing a role in the biodegradation of feedlot waste. Samples of manure were taken from pasture, in situ manure from feedlot pens, and stockpiled manure from a feedlot. Cultures of the filter-sterilized manure extract gave rather conclusive evidence that the substance causing growth inhibition in the extracts was chlortetracycline residue in the excreted manure. It was calculated that 75% of the ingested antibiotic was excreted in the feces. Temperature tests indicate that during the winter months biodegradation of manure is not only inhibited by cold temperatures but also by the persistence of the antibiotic residue and the continuous deposition of antibiotic containing fresh manure. (White-Iowa State)
W71-02739

5C. Effects of Pollution

NATIONAL ESTUARY STUDY --- VOLUME 1. MAIN REPORT.
Fish and Wildlife Service, Washington, D.C.
For primary bibliographic entry see Field 02L.
W71-02217

SHERIFF V CITY OF EASLEY (RIGHT TO FLOW OF UNCONTAMINATED STREAM THROUGH PRIVATE PROPERTY).
For primary bibliographic entry see Field 06E.
W71-02273

NUTRIENT REMOVAL FROM ENRICHED WASTE EFFLUENT BY THE HYDROPONIC CULTURE OF COOL SEASON GRASSES,
Robert S. Kerr Water Research Center, Ada, Okla.
For primary bibliographic entry see Field 05D.
W71-02277

MICROBIAL FACTOR IN MINE DRAINAGE FORMATION,
Mellon Inst., Pittsburgh, Pa.
For primary bibliographic entry see Field 05G.
W71-02278

COLLINS MFG CO V WICKWIRE SPENCER STEEL CO (UPPER RIPARIAN PROPRIETOR MAY NOT POLLUTE WATER TO THE INJURY OF LOWER RIPARIAN PROPRIETOR).
For primary bibliographic entry see Field 06E.
W71-02324

CARETTI V BRORING BLDG CO (LIABILITY FOR POLLUTION OF STREAM).
For primary bibliographic entry see Field 06E.
W71-02424

OIL POLLUTION OF THE OCEAN,
Woods Hole Oceanographic Institution, Mass.
M. Blumer.
In: Oil on the Sea, New York, 1969, p 5-13. 1 fig, 10 ref. FWQA Project 18050 EBN.

Descriptors: *Oily water, *Water pollution effects, *Water pollution sources, Water pollution treatment, Sea water, *Oil wastes, Oil, Pollutant identification, Toxicity, Water pollution control.
Identifiers: Oil pollution, Oil spillage.

The extent of oil pollution of the seas is discussed on a world-wide scale. Contribution from shipping losses alone is estimated at 10 to the 12th power grams per year. The relative toxicities of various oil fractions to marine organisms are discussed and the potential for subtle long-term effects is emphasized. Oil mass identification and the potential biological effects of several oil spill countermeasures are briefly presented. (Hegre - FWQA National Marine Water Quality Laboratory)
W71-02474

HYDROCARBON POLLUTION OF EDIBLE SHELLFISH BY AN OIL SPILL,
Woods Hole Oceanographic Institution, Mass.
M. Blumer, G. Souza, and J. Sass.
Marine Biology, Vol 5, No 3, p 195-202, March 1970. 4 fig, 1 tab, 17 ref.

Descriptors: *Oily water, *Shellfish, *Water pollution effects, *Analytical techniques, *Degradation, Oysters, Gas chromatography, Sea water, Toxicity, Massachusetts, Water pollution sources, *Pollutant identification.
Identifiers: *Natural hydrocarbons, Scallop, Mass spectrometry, *Oil spillage, Oil pollution, Hydrocarbons (Aromatic), Buzzards Bay (Mass).

A spill of 650,000 to 700,000 of No. 2 fuel oil has contaminated the coastal areas of Buzzards Bay, Massachusetts (USA). Gas chromatography demonstrates the presence of this oil in the sediments of the affected area. Two months after the accident, essentially unchanged oil is still being released from the sediments. The presence of the same pollutant is demonstrated in whole oysters Crassostrea virginica and in the adductor muscle of the scallop Aequipecten irradians. A presumably biochemical modification leads to a gradual depletion of the straight chain and, to a lesser extent, of branched chain hydrocarbons. This does not result in detoxification, as the more toxic aromatic hydrocarbons are retained in the organisms several months after the accident. Scallops from an uncontaminated area contain hydrocarbons in lesser amounts and of very different molecular weight and type distribution; they are accountable entirely from biological sources. (Blumer-Woods Hole Oceanographic Institution)
W71-02475

A PREDATOR-PREY RELATIONSHIP. SEA STARS-BIVALVES. THE CHEMICAL BASIS OF THE RESPONSE OF ASTERIAS VULGARIS TO CRASSOSTREA VIRGINICA. A BIOASSAY, ITS APPLICATIONS AND THE PARTIAL PURIFICATION OF AN ACTIVE EXTRACT,
Woods Hole Oceanographic Institution, Mass.
K. J. Whittle, and M. Blumer.
Technical Report, Woods Hole Oceanographic Institution, Reference No 70-20, May 1970. 15 fig, 11 tab, 120 ref. ONR Contract N00014-66-C0241-6, NR 083-004, FWQA Project 18050 EBN, NSF Grant GA-1625, API Grant 85A.

Descriptors: *Attractants, *Molluscs, *Predation, *Bioassay, Chemical analysis, Oysters, Sea water, Fish, Water pollution effects, Pollutant identification, Spectroscopy, Analytical techniques.
Identifiers: *Echinoderms, *Starfish, Chemotaxis.

The chemical basis of the predator/prey relationship, sea stars/bivalves, was examined. Under controlled conditions in a flow-tank, Asterias vulgaris senses intact oysters (Crassostrea Virginica) upstream at distances of at least 120 cm. and shows a positive chemotaxis. It responds similarly to aqueous extracts of oyster tissue at concentrations as low as a few parts per billion. The threshold sensitivity of Asterias vulgaris and Asterias forbesi for an oyster extract was compared. It was measured also for A. vulgaris relative to other bivalves. Contamination of the testing tank with particulate suspensions and oil dispersions at concentrations of less than 10 mg/liter is sufficient to decrease the response to oyster extract and to lower the threshold sensitivity of the sea stars. A reliable, repeatable method was developed for the partial purification of the oyster extract. Infrared spectroscopy indicates that the major functional groups are -OH, -NH and -COOH. It is probable that the activity is centered in a number of polar, low molecular weight compounds (m.w. below a few hundred). They are heat stable at 100C, stable to acid, and not hydrolyzable. (K. J. Whittle-Woods Hole Oceanographic Institution)
W71-02477

ENGINEERING ASPECTS OF THERMAL POLLUTION.
Vanderbilt Univ., Nashville, Tenn. Dept. of Environmental and Water Resources Engineering.

Proceedings of the National Symposium on Thermal Pollution Sponsored by Federal Water Pollution Control Administration and Vanderbilt University, Nashville, Tenn., August 14-16, 1968. Price: $7.95. Frank L. Parker and Peter A. Krenkel, Editors Vanderbilt University Press, Nashville, Tennessee, 1969. 407 p.

Descriptors: *Thermal pollution, *Thermal powerplants, *Economics, *Ecology, *Standards, *Thermal discharges, *Model studies, *Cooling towers, *Cooling water, Temperature, Aquatic environment, Legislation, Screens, Fish, Engineering.

This book is the proceedings of the National Symposium on Thermal Pollution and contains papers regarding the ecological changes of applied significance induced by the discharge of heated waters, the economic considerations in thermal discharge to streams, and several presentations dealing with the engineering aspects of thermal pollution. The cooling of riverside thermal-powerplants, the mechanics of condenser-water discharge from thermal-powerplants, the mathematical and physical modeling of heated-water discharges, and the design and operation of cooling towers were discussed in detail. The horizontal traveling screen for prevention of the entrance of fish into cooling water intake canals, and the development and administration of water quality standards for temperature were also discussed. A summary of the status of thermal pollution control and abatement is included. Each presentation includes a review of past and current research in that specific area and makes recommendations for future applied research. The concluding presentation summarizes the research needs for thermal pollution control. (See also W71-02479 thru W71-02490) (Speakman-Vanderbilt)
W71-02478

ECOLOGICAL CHANGES OF APPLIED SIGNIFICANCE INDUCED BY THE DISCHARGE OF HEATED WATERS,
Aston Univ., Birmingham (England). Dept. of Biological Sciences.
H. A. Hawkes.
In: Engineering Aspects of Thermal Pollution, Chapter 2, p 15-57, 1969. 4 tab, 3 fig, 84 ref.

Descriptors: *Temperature effects, *Thermal pollution, *Ecology, Algae, Bacteria, Coliforms, Fish, Fungi, Heat, Water pollution, Streams, Rivers, Lakes, Physiological ecology, Limiting factors, Ecosystems, Microorganisms, Aquatic microorganisms, Enzymes.

The general review of ecological aspects of thermal pollution is discussed. Temperature of water is an ecological factor which influences all forms of biological life in water. The minimum, optimum, and harmful temperature ranges for all kinds of biota in waters is discussed. The temperature influences the microbiological organisms by its effects on enzymes, which are inactivated at high temperatures. The most obvious effect of the raised water temperature on fish is the direct autecologi-

cal one, affecting the distribution of each species according to their temperature tolerance ranges. The optimum temperature ranges for fish are presented, and indirect effects of raised temperature on fish are discussed (decrease of oxygen level, increase of toxicity effects, etc.). The paper also discusses the temperature effects on macro-invertebrates, algae, bacteria, and fungi. (See also W71-02478) (Novotny-Vanderbilt)
W71-02479

THERMAL POLLUTION,
Federal Water Pollution Control Administration, Washington, D.C.
Joe G. Moore, Jr.
In: Engineering Aspects of Thermal Pollution, Chapter 8, p 243-248, 1969.

Descriptors: *Thermal pollution, *Temperature, *Cooling water.
Identifiers: Ecological effect.

Since the end of World War II, construction of scores of new power-generating plants has resulted in a growing public concern about hot water. The sudden rise in public awareness has far outstripped our knowledge of the ecological effects of large discharges of heated water in our rivers, lakes and estuaries. It is estimated that by 1978 approximately one-sixth of the total fresh water run-off in the United States will be used for cooling and consdensing purposes. The cooling water requirements for the nuclear power facility at Browns Ferry, Alabama, on the Wheeler Reservoir will be 2.8 billion-gallons per day. The temperature increase in the cooling-water, from intake to discharge, will zoom 25F in six minutes. The use of diffuser pipes at the bottom of the reservoir is proposed for disposal of this water. Another example is the Turkey Point facility, which will increase its cooling water requirement from 192 million gallons now to 3.15 billion gallons per day by 1972. There is already evidence of a substantial temperature increase in Biscayne Bay, a national treasure. What will happen when cooling water volume is increased more than 16-fold is unknown. The effective methods of control of waste heat are cooling towers, dilution of waste heat, use of aerated ponds, recycling of condenser water and operating the plant at minimal level during periods when addition of heat would be more hazardous. (See also W71-02478) (Upadhyaya-Vanderbilt)
W71-02487

SUMMARY AND STATUS OF THE ART,
Vanderbilt Univ., Nashville, Tenn. Dept. of Environmental and Water Resources Engineering.
For primary bibliographic entry see Field 05D.
W71-02490

BIOLOGICAL ASPECTS OF THERMAL POLLUTION.
Vanderbilt Univ., Nashville, Tenn. Dept. of Environmental and Water Resources Engineering.

Proceedings of the National Symposium on Thermal Pollution, Sponsored by the Federal Water Pollution Control Administration and Vanderbilt University, Portland, Oregon, June 3-5, 1968, Price: $7.95. Peter A. Krenkel and Frank L. Parker, editors, Vanderbilt University Press, Nashville, 1969. 351 p.

Descriptors: *Thermal pollution, *Thermal powerplants, *Ecology, *Biota, *Temperature, *Aquatic environment, *Aquatic life, *Aquatic populations, Algae, Benthos, Zooplankton, Freshwater fish, Estuarine environment, Impounded waters, Freshwater algae, Anadromous fishes.

The proceedings of the National Symposium on Thermal Pollution - Biological considerations - are included in this book. A brief discussion of the engineering problems of thermal pollution includes stratification of impounded waters, the contribution of heat from power plants, cooling water requirements, natural heat dissipation mechanisms, and alternative methods for cooling water. Reports and discussions concerning the effects of thermal pollution on freshwater algae, marine zooplankton, British freshwater fishes, Anadromous fishes, and freshwater benthos are presented. The development of thermal requirements of freshwater fishes, theoretical considerations of thermal pollution on marine fishes at various life stages, and the potential effect of thermal alteration on marine and estuarine benthos are also discussed. Most presentations include reviews of past and current literature and recommendations, and the final presentation deals exclusively with research needs for thermal pollution. (See also W71-02492 thru W71-02498) (Speakman-Vanderbilt)
W71-02491

ENGINEERING ASPECTS, SOURCES, AND MAGNITUDE OF THERMAL POLLUTION,
Vanderbilt Univ., Nashville, Tenn. Dept. of Environmental and Water Resources Engineering.
For primary bibliographic entry see Field 05B.
W71-02492

REMARKS ON THE EFFECTS OF HEATED DISCHARGES ON MARINE ZOOPLANKTON,
Scripps Institution of Oceanography, La Jolla, Calif.
J. B. Strickland.
In: Biological Aspects of Thermal Pollution, Chapter 3, p 73-77, 1969.

Descriptors: *Zooplankton, *Thermal pollution, *Hydrodynamics, *Aquatic life, Food chain, Dominant organisms, Aquatic environment, Ecology, Physics, Temperature, Thermal effects.
Identifiers: *Marine environment.

To date, little is known concerning the extent of the effect on the entire food chain and its indirections and feedbacks on any particular part of it. Although clearly more is known now than was known a decade ago, the more that is known, the more complicated and interreacting it becomes. Before meaningful predictions concerning marine zooplankton can be made, much more about the physics and hydrodynamics of the discharge process must be known. Not enought is known about the kinetics of the remineralization process. The basic problem is marine and probably freshwater ecology is one of manpower; the training of enough people of sufficient caliber to make intelligent predictions about the results of thermal pollution in the environment is not progressing fast enough. (See also W71-02491) (Speakman-Vanderbilt)
W71-02493

ASPECTS OF THE POTENTIAL EFFECT OF THERMAL ALTERATION ON MARINE AND ESTUARINE BENTHOS,
Oregon State Univ., Newport. Yaquina Bilogical Lab.
Joel W. Hedgpeth, and Jefferson J. Gonor.
In: Biological Aspects of Thermal Pollution, Chapter 4, p 80-118, 1969. 7 fig, 1 tab, 91 ref.

Descriptors: *Benthos, *Temperature, *Thermal pollution, Laboratory animals, Acclimatization, Marine animals, Aquatic life, Aquatic animals, Benthic fauna, Aquatic plants, Marine algae, Benthic flora, Estuaries, *Estuarine environment, Bays, *Fluctuation, Resistance, Life cycles, Growth stages.
Identifiers: Temperature ranges, Temperature requirements.

Laboratory experiments on thermal tolerances, death points, and the life, without reference to the natural conditions, including previous temperature experience and state of tide or season at which experimental material was gathered, have questionable utility in reference to what the organisms may actually do in nature. Intensive field studies with in situ measurements of the environment and the organisms, combined with continuous monitoring, especially of thermal gradients, are needed. Field evidence indicates that some intertidal herbivores are well adjusted to the temperature ranges from seawater to rather high air temperatures for varying periods of time, and that indeed such a temperature range may be an ecological requirement, rather than an environment to be endured. How extensive this may be, and to what degree it may apply also to subtidal organisms, remains to be determined. There is evidence indicating that some marine organisms do not flourish in a stable temperature regime but require the variation around the statistical mean. However, such temperature requirements are not yet established for many organisms, since most experiments involving laboratory culture are of comparatively short duration. In contrast to the observed ability of many marine organisms to withstand wide ranges of environmental temperatures at some stages of their life cycles, there is the growing body of evidence that comparatively small fluctuations in oceanic temperatures may influence the distribution and abundance of many species, especially those that occur in large populations. (See also W71-02491) (Speakman-Vanderbilt)
W71-02494

DEVELOPING THERMAL REQUIREMENTS FOR FRESHWATER FISHES,
Federal Water Pollution Control Administration, Duluth, Minn.
Donald I. Mount.
In: Biological Aspects of Thermal Pollution, Chapter 6, p 140-147, 1969.

Descriptors: *Temperature, *Fish, Thermal pollution, Fish food organisms, Food chains, Growth rates, Reproduction.
Identifiers: *National Water-Quality Laboratory, *Thermal requirements, Harvestable species, Temperature fluctuations.

The research undertaken at the National Water-Quality Laboratory is being concentrated on developing thermal requirements of the harvestable aquatic species (shell- and fin-fishes) and the critical food-chain organisms on which they feed. The two primary functions which cannot be altered if a satisfactory crop of fish is to be maintained are reproduction and growth. Therefore, research is now centered around determination of maximum temperatures at which normal growth and reproduction can occur without impairment; the extent to which temperatures may fluctuate without interfering with growth and reproduction; and whether cooler temperatures are necessary for reproduction to occur. Field study sites at the St. Croix River in Minnesota and at the Mississippi River at Monticello, Minnesota, are being used to study maximum temperatures at which some critical species will spawn and grow normally, and to study the effects of elevated temperatures on critical food-chain organisms respectively. (See also W71-02491) (Speakman-Vanderbilt)
W71-02495

SOME EFFECTS OF TEMPERATURE ON FRESHWATER ALGAE,
Academy of Natural Sciences of Philadelphia, Pa. Dept. of Limnology.
Ruth Patrick.
In: Biological Aspects of Thermal Pollution, Chapter 7, p 161-185, 1969. 53 ref.

Descriptors: *Algae, *Temperature, Diatoms, Photosynthesis.
Identifiers: *Blue-green algae, *Green algae, *Red algae, *Temperature tolerance, Optimum growth temperature, Condenser paggage.

Most of the common freshwater algae belong to the green algae, diatoms, red algae, and blue-green algae groups. In each of these major groups there are many species. These species cover a wide range of temperatures from those that prefer cool-water conditions to those that prefer very warm water

conditions. Each species has a range of temperature that it can tolerate and a range in which its growth is optimum. In general, the blue-green algae have more species that prefer temperatures from 35C upward, whereas the green algae have a relatively large number of species that grow best in temperatures ranging up to 35C. Most diatom species prefer temperatures below 30C. The effect of artificially increasing the temperature regime of a species tends to increase growth and photosynthesis so long as light is sufficient for these functions and the limits of temperature tolerance are not reached. As one approaches the limits of temperature tolerance for a species, cell division is repressed, as is photosynthesis, and the formation of reproductive cells may be repressed. The pattern of growth may be greatly altered. The temperatures at which species may successfully grow in the laboratory may be higher than those which occur in nature because of lack of competition with other species under natural conditions and the effect of predator pressure. Studies made concerning the effect on algae of passing them through a condenser indicate that if the temperature does not exceed 34-34.5C, little, if any, harm is done. (See also W71-02491) (Speakman-Vanderbilt)
W71-02496

EFFECT OF HEATED DISCHARGES ON FRESHWATER FISHES IN BRITAIN,
Ministry of Agriculture, Fisheries and Food, London (England).
John S. Alabaster.
In: Biological Aspects of Thermal Pollution, Chapter 11, p 354-370, 1969. 9 fig, 6 ref.

Descriptors: *Fish, *Thermal pollution, Thermal power, Cooling, Trout, Perches, Carp, Cooling towers, Heated water, Environmental effects, Fish management, Streams, Rivers, Food chains.
Identifiers: Britain, Great Britain, *Temperature effects.

The increase in temperature of the water used by electricity-generating stations for cooling purposes is often potentially lethal during the summer to trout and to the more sensitive species of coarse fish, such as roach, perch, and gudgeon, though not to tench and carp. Coarse fish are present in most rivers receiving these heated discharges but are rarely killed even close to the effluent outfall, probably because they avoid lethal conditions which are often confined to the surface layers, and also because those fish exposed to heated water in the neighborhood of outfalls have become partially acclimated to temperatures above normal and thus become more resistant. When fish are killed, effluent temperatures are higher than normal, either because of exceptional operating conditions or intentionally for experimental purposes, but many fish apparently escape successfully. Most danger occurs near the outfalls, particularly when effluent recirculates both in the river and through cooling towers. Effluent temperatures are not always potentially level, even in summer, and may attract roach, gudgeon, carp, tench, and bream. Indirect effects of heated effluents on fish in polluted rivers are likely to be important. (See also W71-02491) (Novotny-Vanderbilt)
W71-02497

POLYCHLORINATED BIPHENYLS,
For primary bibliographic entry see Field 05A.
W71-02678

PHOSPHORUS, NITROGEN, AND ALGAE IN LAKE WASHINGTON AFTER DIVERSION OF SEWAGE,
Washington Univ., Seattle. Dept. of Zoology.
W. T. Edmondson.
Science, Vol 169, No 3946, p 690-691, August 14, 1970. 2 fig, 8 ref.

Descriptors: Sewage effluents, *Algae, *Phytoplankton, *Aquatic productivity, *Phosphates, *Nitrates, *Chlorophyll, Diversion, Carbon dioxide, Alkalinity, Epilimnion, Washington, Phosphorus, Nitrogen, Nutrients.
Identifiers: Lake Washington (Washington).

Because of the large amounts of phosphorus and nitrogen being added to Lake Washington from sewage effluent, a program was set up to divert all sewage from the lake. The first diversion of 11 treatment plants occurred in 1963. From 1963 to 1969, phosphate decreased to 28% of the 1963 concentration, but nitrate remained at more than 80% of the 1963 value. Free carbon dioxide and alkalinity remained relatively high. The amount of phytoplanktonic chlorophyll in the summer was very closely related to the mean winter concentration of phosphate, but not to that of nitrate or carbon dioxide. Phytoplankton counts have not been completed, but data are available on the chlorophyll content of the phytoplankton in the epilimnion. The relationship between the summer mean and the concentration of phosphate in the surface water during the previous winter strongly suggests that phosphorus is the most important limiting element in Lake Washington. Two included graphs show the mean winter values of phosphate, nitrate, chlorophyll, and surface phytoplankton; and correlation between surface values of phosphate and nitrate during the spring increase of phytoplankton when the concentrations of nutrients are decreasing. (Little-Battelle)
W71-02681

POLYCHLORINATED BIPHENYLS (PCB) SOLUBILIZED IN WATER BY NONIONIC SURFACTANTS FOR STUDIES OF TOXITY TO AQUATIC ANIMALS,
Fisheries Research Board of Canada, St. Andrews (New Brunswick). Biological Station.
V. Zitko.
Bulletin of Environmental Contamination and Toxicology, Vol 5, No 3, p 279-285, 1970. 2 fig, 1 tab, 8 ref.

Descriptors: *Atlantic salmon, *Toxicity, *Spectrophotometry, *Gas chromatography, *Absorption, *Surfactants, *Solubility, Chlorinated hydrocarbon pesticides, Solvation, Ultraviolet radiation, Fluorescence, Fishkill, Fresh water, Sea water, Bioassay, Water pollution effects.
Identifiers: *Aroclors, *Polychlorinated biphenyls.

This paper describes the solubilization of PCB in water by a nonionic surfactant, Corexit 7664; determination of concentration of the solubilized PCB by UV spectrophotometry and fluorescence; some properties of aqueous PCB solutions; and preliminary results on the toxicity of PCBs to Atlantic salmon (salmo salar) parr. The PCB preparations were Aroclor 1221 and Aroclor 1254 (containing 21% and 54% chlorine respectively). Solubilities of PCB were determined in both fresh and seawater. The toxicity tests were conducted using two flasks at each Aroclor concentration: one containing two fish, the other without fish. Initial concentrations were 0.9 and 2.5 mg/l for Aroclor 1254 and 0.9 mg/l for Aroclor 1221. The results of the tests are included in graphs. The following conclusions were made: (1) The determined levels of solubility of PCB in water were reached by very vigorous dispersing of the PCB in water, and it would be difficult to scale up this procedure. As indicated by the toxicity data, lethal levels would be reached only in the case of Aroclor 1221. (2) Solubilization of PCB in water by relatively nontoxic, nonionic surfactants is a reproducible and convenient method for dosing PCB in experiments with aquatic animals. (3) Concentration of the solubilized PCB can be readily monitored by spectrophotometry or by fluorescence at a rate of 20-30 analyses per hour; continuous monitoring is also possible. (4) There is no difference in optical properties between PCB solubilized in water by nonionic surfactants and true solutions of PCB in ethanol. (5) The preliminary tests indicate that PCB may be less toxic to Atlantic salmon parr than chlorinated hydrocarbon pesticides. (Little-Battelle)
W71-02682

IMPACT OF AGRICULTURAL POLLUTANTS ON WATER USES,
Robert S. Kerr Water Research Center, Ada, Okla.
For primary bibliographic entry see Field 05A.
W71-02687

SOIL FERTILITY UNDER CONTINUOUS CULTIVATION IN NORTHERN NIGERIA. I. THE ROLE OF ORGANIC MANURES,
R. G. Heathcote.
Experimental Agriculture. Vol 6, No 3, p 229-237, 1970. 13 tab, 14 ref.

Descriptors: *Trace elements, *Limiting factors, Farm wastes, Fertilizers, Crop response, Deficient elements.
Identifiers: Organic fertilizers, Nigeria, Organic manures.

Soil acidity, incipient potassium deficiency, and a deficiency of one or more trace elements were limiting factors in three trials of long-term soil fertility changes under continuous cultivation in the Sudan Savanna zone of Nigeria. The effectiveness of organic manures is explained largely or wholly in terms of these factors, since no evidence has yet been found to suggest that the addition of organic matter as such is of value. (Christenbury-Iowa State)
W71-02690

ENVIRONMENTAL POLLUTION--NOW AND IN THE YEARS AHEAD,
Office of Science and Technology, Washington, D.C.
Donald R. King.
In: Animal Waste Management, Proceedings Cornell University Conference on Agricultural Waste Management, p 4-8, 1969.

Descriptors: *Farm wastes, *Environment, Legal aspects, Research and development, Design standards, Waste treatment, Waste disposal.
Identifiers: *Agricultural Pollution, Resource conservation, Waste uses, Land planning.

The report points out several avenues that warrant research attention; among them the following: (1) The potential benefits to control which may result from changing the character of animal wastes. (2) Information is needed on present control approaches to make them more generally applicable. (3) The tremendous volume of animal wastes produced necessitates the development and application of new and more effective treatment and disposal methods. (4) Additional attention to potential uses for animal wastes would be desirable. (5) Land use planning also warrants emphasis. (6) Additional information also will be needed on the relationships of wastes to agricultural production which can be used to assist in establishing standards. (White-Iowa State)
W71-02703

WASTE DISPOSAL MANAGEMENT,
Cornell Univ., Ithaca, N.Y.
For primary bibliographic entry see Field 05B.
W71-02729

5D. Waste Treatment Processes

REMOVAL OF PHOSPHATE FROM WATER BY ALUMINUM AND IRON, PHASE II,
Rutgers - The State Univ., New Brunswick, N.J. Water Resources Research Inst.
Pa Ho Hsu.
Available from NTIS as PB-196 109, $3.00 in paper copy, $0.95 in microfiche. New Jersey Water Resources Research Institute, Technical Completion Report, December 1970. 5 p. OWRR Project A-021-NJ (1).

Descriptors: *Phosphates, Chemical precipitation, Water pollution, *Waste water treatment, Clay minerals, Aluminum, Iron compounds, Water purification.

Identifiers: *Phosphate removal, Aluminum phosphate, Iron phosphate.

Effects of foreign components on the precipitation of phosphate by aluminum and precipitation of phosphate by ion were studied. The effectiveness of hydroxy-aluminum polymers to precipitate phosphate is greatly influenced by the ratio of phosphate to aluminum and also by the nature and the concentration of the foreign componets (sulfate, fluoride, kaolinite and montmorillonite) present. Phosphate precipitation was greatly improved in some cases while reduced in others. The composition of the waste water to be treated and that of coagulants added must be taken into consideration in any laboratory study or practical process of phosphate removal from waste water. Samples were prepared by mixing Fe (NO3)3,NaH2PO4 and NaOH together and then analyzed for the concentrations of phosphate and iron remaining in solution and the composition of the precipitate. The optimum pH for phosphate precipitation greatly varies with the amount of phosphate relative to that of iron present. Phosphate forms stable soluble complexes, thus frequently causing difficulty in obtaining complete precipitation of phosphate and iron. Some irreversible or very slowly reversible steps are involved in the process of sample preparation. Therefore, for any laboratory study or practical waste water treatment, the process of mixing reactants must be carefully controlled. (Hsu-Rutgers)
W71-02272

NUTRIENT REMOVAL FROM ENRICHED WASTE EFFLUENT BY THE HYDROPONIC CULTURE OF COOL SEASON GRASSES,
Robert S. Kerr Water Research Center, Ada, Okla.
James P. Law, Jr.
Available from NTIS as PB-196 112, $0.95 in microfiche. For sale by the Superintendent of Documents, US Government Printing Office, Washington, D.C. 20402. Price $0.50, Order no I67.13/4:16080/1069. Water Pollution Control Research Series 16080---10/69, October 1969. 33 p, 13 tab, 3 fig, 10 ref. FWQA Program 16080---10/69.

Descriptors: *Hydroponics, Tertiary treatment, Waste water treatment, Grasses, Fescue, Waste assimilative capacity, Nutrients, Nitrogen, Phosphorus, *Sewage effluents, Effluents.
Identifiers: *Nutrient removal, Cool season grasses, Ryegrass, Nitrogen removal.

Grasses were grown in hydroponic culture tanks to evaluate their nutrient removal capabilities when supplied with secondary-treated sewage effluent as the sole source of plant nutrients. Statistical methods were employed to determine the effects of the grasses, flow rates, and seasons on nutrient removal. Two control tanks with gravel bed and no grass were maintained throughout the study, two were planted with tall (Ky 31) fescue, and two were planted with perennial ryegrass. Two flow rates were maintained in each pair of tanks, approximately one-day and two-day detention times. All six tanks were effective in reducing the oxygen-demanding organic content of the effluent. Total nitrogen content was reduced appreciably by the control tanks, but the grass tanks were significantly better at nitrogen removal. Total phosphorus concentrations were reduced only slightly by passage through the tanks. The fast flow rate tanks produced the greater grass yields, while the slow flow rate tanks were more effective in nutrient removal from the sewage effluent. From grass yield and analyses data, the amount of plant nutrient material removed by the grasses was small compared to the total quantity supplied. Further studies are suggested to determine economic factors and design parameters.
W71-02277

MICROBIAL FACTOR IN MINE DRAINAGE FORMATION,
Mellon Inst., Pittsburgh, Pa.
For primary bibliographic entry see Field 05G.
W71-02278

STUDIES RELATING TO MARKET PROJECTIONS FOR ADVANCED WASTE TREATMENT,
Federal Water Pollution Control Administration, Cincinnati, Ohio.
Louis Koenig.
Available from the NTIS as PB-187 862, $3.00 in paper copy, $0.95 in microfiche. FWQA, Cincinnati Water Research Laboratory, Robert A Taft Sanitary Engineering Center, Report WP-20-AWTR-17, December 1966. 72 p, 8 fig, 13 tab, 23 ref, 1 app. FWQA Project 17000--12/66, Contract PH-86-64-39.

Descriptors: *Waste water treatment, *Economics, Distillation, Adsorption, Electrodialysis, Water reuse.
Identifiers: *Ultimate disposal.

To assess the present status of waste water treatment, the type of treatment now in use and the amount of waste water discharged, were determined for the major streams in the country. About 4% of 100-mile river basins now have full secondary treatment. A study was made to determine the percentage of municipal waste water present in surface supplies of 155 cities of populations of 25,000 or more. The maximum was 18% and median was 3.5%. Consideration was given in this study to the possibility of logistical imbalances that might occur if advanced waste treatment was applied to nearly all waste waters. If a distillation-adsorption system was used, less than 6% of the nation's annual fuel consumption would be used and less than 0.5% of the total power generation would be required. Activated carbon needs, however, would double. If electrodialysis was applied, 4% of the national power would be required. Membrane production would have to increase several thousandfold. Ultimate disposal of concentrates by injection, incineration, pipelining, etc., would create no imbalances. (Selby-Texas)
W71-02279

FEASIBILITY OF GRANULAR, ACTIVATED-CARBON ADSORPTION FOR WASTE WATER RENOVATION,
Pittsburgh Chemical Co., Pa.
R. S. Joyce, and V. A. Sukenik.
Available from NTIS as PB-168 838, $3.00 in paper copy, $0.95 in microfiche. FWQA Robert A Taft Sanitary Engineering Center, Report AWTR-10, May 1964. 32 p, 1 app, 9 fig, 9 tab. FWQA Project 17020--05/64, Contract SAph-86-62-15.

Descriptors: *Waste water treatment, *Activated carbon, Adsorption, Cost, Alkylbenzene sulfonates, Detergents, Water reuse.
Identifiers: Packed beds, Reactivation.

This study was initiated to estimate the optimum bed depth and flow rates necessary for most economical use of the adsorptive properties of carbon and to examine the feasibility of regenerating the carbon. The results show that granular activated carbon in packed-bed column contractors remove much of the organic matter including alkybenzene-sulfonate from municipal waste water. The COD of a secondary effluent was reduced to about 12 to 20 ppm and the ABS was removed almost entirely. When an ABS breakthrough concentration of 0.5 ppm is used as a criterion of carbon exhaustion, the amount of carbon required for countercurrent contacting is less than one pound per 1,000 gallons. For the process to be economical the carbon must be reactivated and re-used. Thermal reactivation in a steam-air atmosphere was found to be technically feasible. With reactivation, the total cost of carbon adsorption was estimated to be less than 10 cents per 1,000 gallons for plants treating 10 mgd of waste water. (Selby-Texas)
W71-02280

ADVANCED WASTE TREATMENT RESEARCH PROGRAM.
Advanced Waste Treatment Research Program, Cincinnati, Ohio.
Available from NTIS as PB-168 837, $3.00 in paper copy, $0.95 in microfiche. FWQA Robert A. Taft Sanitary Engineering Center, Summary Report, AWTR-14, Jan 1962-June 1964, April 1965. 142 p, 24 ref, 56 fig, 9 tab. FWQA Project 17000-04/65.

Descriptors: *Waste treatment, *Adsorption, Foaming, Electrodialysis, Distillation, Freezing, Reverse Osmosis, Solvent extractions, Ultimate disposal, Waste water treatment.
Identifiers: Chemical oxidation.

Under an extensive contract research program, the Public Health Service's Advanced Waste Treatment Research Program, between January 1962, and June 1964, studied a wide range of physical-chemical separation processes to evaluate their effectiveness in purifying municipal and industrial waste waters. Laboratory investigations have shown that adsorption by granulated activated carbon is an effective method of removing organic contaminants but that other possible low-cost adsorbent materials studied failed to produce consistently effective organic removals. Studied were foaming of secondary effluent, single-pass electrodialysis, distillation, reverse osmosis, freezing, and solvent extraction with low-molecular-weight secondary and tertiary amines. In anticipating various approaches to the chemical oxidation of organic contaminants in waste water, the active-oxygen process appears to offer the best potential for technical and economic success. Ultimate disposal of concentrated wastes resulting from the application of physical-chemical separation processes to waste waters has been considered by methods such as (1) wet oxidation, (2) incineration, (3) injection to porous underground formations, (4) placement in natural or man-made underground cavities (Salt cavities, mined or nuclear blast cavities), and (5) disposal in the ocean after pipeline conveyance from point of origin. (Selby-Texas)
W71-02281

EVALUATION OF THE USE OF ACTIVATED CARBONS AND CHEMICAL REGENERANTS IN TREATMENT OF WASTE WATER,
Dow Industrial Service, Cleveland, Ohio.
R. L. Johnson, F. J. Lowes, Jr., R. M. Smith, and T. J. Powers.
Available from NTIS as PB-168 795, $3.00 in paper copy, $0.95 in microfiche. FWQA Robert A. Taft Sanitary Engineering Center Report AWTR-11, May 1964. 48 p, 24 fig, 9 tab, 38 ref. FWQA Project 17020-05/64, Contract SAph 76290.

Descriptors: *Waste water treatment, *Activated carbon, Adsorption, Economics, Chemical oxygen demand.
Identifiers: *Hydrogen Peroxide, Regeneration.

By using a continuous-flow, column-type test, the capacities of six activated carbons for the soluble organics in filtered secondary effluent were obtained. Results varied from 7 to 13 grams COD per 100 grams of carbon. Because of the manner in which the test was carried out, only the carbon with the smallest capacity was loaded to the maximum extent possible. The chemical regeneration of exhausted carbon was investigated by use of nine inorganic oxidizing agents: chlorine, bromine, potassium permanganate, sodium dichromate, sodium persulfate, potassium persulfate, sodium peroxide, hydrogen peroxide, and ozone. Only hydrogen peroxide was capable of restoring measureable adsorption capacity after more than two cycles of exhaustion and regeneration. The economic feasibility of chemical regeneration is not promising. (Selby-Texas)
W71-02282

METROPOLITAN PLANNING GUIDELINES, SEWAGE TREATMENT (FACILITIES).
Northeastern Illinois Planning Commission, Chicago, Illinois.

Northeastern Illinois Planning Commission Report, April 1965. 33 p, 9 fig, 9 tab, 14 ref. HUD Grant.

Descriptors: *Sewage treatment, *Waste water treatment, *Urbanization, *Cities, *Municipal wastes, Septic tanks, Illinois, Surveys, Waste water disposal, Sewage, Planning.
Identifiers: *Metropolitan planning, *Chicago.

The findings are summarized of a project designed to: (1) inventory public sewage treatment facilities in the six-county Chicago metropolitan area; and (2) to determine how much new development has taken place inside and outside the areas served by these systems. The data were derived from field surveys, interviews, and unpublished materials. The information is intended for use in the preparation of a comprehensive metropolitan plan. In 1964, approximately 90 percent of the metropolitan area population was served by public sewers, while 10 percent relied on septic tanks and other private equipment. Seven hundred square miles were served by 128 sewer systems and over 3,000 square miles by septic tanks and other facilities. Sewered areas have a gross population density of 8,000 persons per square mile compared with 1,300 for non-sewered areas. Sewage treatment systems are small, serving about one square mile on the average. Three problem areas requiring further study and definition were identified. They are: (1) pollution of surface and ground waters, (2) cost of sewage treatment, and (3) improper size and location of treatment plants for expansion to meet future needs. Figures, charts and tables are included to document the type, capacity, efficiency, age, location and area served by public treatment facilities in Cook, DuPage, Will, Lake, Kane and McHenry counties. (Poertner)
W71-02284

CITY OF SAN DIEGO WATER RECLAMATION STUDY FOR BALBOA PARK AND MISSION BAY PARK.
Boyle Engineering, San Diego, California.

Report to City of San Diego, California, March 1963. 250 p, 40 fig, 50 tab, 52 ref.

Descriptors: *Water reuse, *Irrigation programs, *Groundwater recharge, *Return flow, *Irrigation water, Parks, California, Reclaimed water, Water spreading, Artificial recharge, Saline water intrusion, Irrigation engineering, Irrigation systems, Water supply.
Identifiers: *San Diego.

Benefits are indicated that would result from the conservative re-use of a portion of San Diego's sewage, currently wasted to the ocean; and presents alternative plans for the implementation of a project that would supply the irrigation water requirements of Balboa Park and Mission Bay Park. Each of several alternative plans is economically feasible and it is in the best interests of the City to actively enter the field of water reclamation. It is recommended that: (1) the City pursue a plan of action leading to the design, construction and operation of a water reclamation system with adequate capacity to serve the irrigation requirements of both Balboa Park and Mission Bay Park; (2) areas owned by the City in the vicinity of the designated water reclamation plant sites should be tentatively set aside for water reclamation purposes; and (3) the City should reevaluate the potential value of ground water recharge using reclaimed water in Mission Valley, with the possibility of reactivating the City's Mission Valley well field as a supplemental potable water supply. San Diego presently imports up to 96 percent of its annual water requirements from the Colorado River. The California Water Plan includes provisions for furnishing water to San Diego from Northern California; however, the cost will be from three to five times the present cost of imported water. (Poertner)
W71-02287

MECHANICAL - DRAFT COOLING TOWERS,
Carter Thermal Engineering Ltd.
G. B. Hill.
Chemical and Process Engineering - Heat Transfer Survey, p 33-40, 1969.

Descriptors: *Cooling, *Thermal pollution, Thermal powerplants, *Cooling towers, Cooling water, Heating, Heat budget, Atmosphere, Humidity, Heat transfer, Recirculated water.
Identifiers: Mechanical - Draft cooling.

The use and advantages of mechanical-draught cooling towers is discussed as to theory, construction, operation and suitability. For theoretical evaluations the simplifying approximation of Merkel's total heat theory is used. As to construction, the main emphasis is put on packing where most of the cooling of the water takes place. Splash packing and film packing (in grid or plate arrangements) are the most commonly used. Mechanical-draught cooling towers have a relatively simple construction, although the heat transfer processes which take place within them are extremely complex. Except for ambient air wet bulb temperature, they are virtually independent of atmospheric conditions. They can cool water to temperatures below ambient with low capitol and operational costs in a comparatively small space. To quote for a tower, manufacurers require information on cooling duty, restrictions are on height or weight and noise limitations. (Novotny-Vanderbilt)
W71-02308

HYDROLOGY OF SPRAY-RUNOFF WASTE WATER TREATMENT,
Robert S. Kerr Water Research Center, Ada, Okla.
Richard E. Thomas, James P. Law, Jr., and Curtis C. Harlin, Jr.
ASCE Proceedings, Journal of the Irrigation and Drainage Division, Vol 96, No IR3, Paper 7538, p 289-298, September 1970. 10 p, 4 fig, 4 tab, 15 ref.

Descriptors: *Waste water disposal, *Soil disposal fields, *Overland flow, *Runoff, *Sprinkler irrigation, Evaporation, Evapotranspiration, Water balance, Hydrologic budget, Sewage treatment, Soil water movement, Waste treatment.
Identifiers: Spray-runoff waste water treatment.

Liquid measuring procedures used in a 12-month study of the hydrology of the soil treatment system at Campbell Soup Company's Paris, Texas plant accounted for 93% of the total liquid applied to the soil. The rainfall and waste water applied to the soil system are accounted for as follows: 18% is lost to the atmosphere through evaporative processes; 61% is recovered as runoff; and 21% percolates through the soil. The fraction of the treated waste water recovered as runoff ranges from a low of 30% to a high of 85%. This range in the percent runoff is influenced by climate, soil textural class, and waste water spray schedules. Waste water spray schedules are controlled to partially offset variations in the percent runoff which would normally occur as the result of climatic influences. (Knapp-USGS)
W71-02437

ENGINEERING ASPECTS OF THERMAL POLLUTION.
Vanderbilt Univ., Nashville, Tenn. Dept. of Environmental and Water Resources Engineering.
For primary bibliographic entry see Field 05C.
W71-02478

MECHANICS OF CONDENSER WATER DISCHARGE FROM THERMAL POWERPLANTS,
Massachusetts Inst. of Tech., Cambridge, Mass. Dept. of Hydraulic Engineering.
Donald R. F. Harleman.
In: Engineering Aspects of Thermal Pollution, Chapter 5, p 144-164, 1969. 13 fig, 9 ref.

Descriptors: *Thermal powerplants, *Thermal pollution, *Stratification, Mixing.
Identifiers: *Densimetric Froude number.

This paper discusses some of the techniques in the planning and design stage which should be used in considering whether all or a portion of the total waste heat from thermal or nuclear power plants is to be disposed of into an adjacent waterway. Also discussed is the degree of flexibility in controlling conditions in the waterway which is available to the engineer. The interrelationship between the design of the outlet and intake structures for stratification of the condenser water in the adjacent water-way is analyzed, and it is shown that the primary requirement for stratification is an outlet channel designed to have a densimetric Froude number less than unity. The mixing of the heated condenser water by means of a diffuser pipe extending across the river bottom transverse to the direction of the flow is also analyzed. The model experiments of a section of the diffuser pipe of Brown's Ferry's Nuclear powerplant are explained. Some conclusions were: (a) Analytical techniques based on the mechanics of thermally stratified flow can be used in the design of condenser water intake and discharge structures. (b) The designer has a high degree of flexibility in controlling the environmental changes in a waterway receiving thermal discharges from a powerplant. (c) Thermal conditions ranging from stratification of the effluent to complete mixing can be achieved through proper design. (See also W71-02478) (Guerrero-Vanderbilt)
W71-02482

DESIGN AND OPERATION OF COOLING TOWERS,
Public Service Co. of Colorado, Denver.
Charles Waselkow.
In: Engineering Aspects of Thermal Pollution, Chapter 9, p 249-271, 1969.

Descriptors: *Temperature, *Cooling towers, *Cooling water, Thermal pollution, Design criteria, Operation and maintenance.
Identifiers: GEA Air Exchangers-Bochum-West Germany, Wet-bulb temperature, Drift loss, Tower fill, Road-hazard.

One of the truly critical design criteria necessary to a good cooling-tower design is the determination of the design inlet wet-bulb temperature. This temperature should be for the weather conditions encountered during the four summer months of the year. The average steam plant rejects about 5500 to 6000 BTU per Kwhr. Drift loss (0.2%) must be considered in cooling tower design. The sewage effluent used for cooling contains detergents and some organic matter which proved troublesome when the drift spray was carried to the nearby substation by the prevailing winds. One of the remedial measures taken was the installation of additional mist eliminators in the plenum of the cooling tower. The wood deterioration on the Public Service company of Colorado towers is unexplainable. The deterioration of the redwood which is used as towerfill at any one of the three stations bears no resemblance to that at either of the others. One important item of public relations, as it concerns cooling tower operations, is the problem of road hazard. The cooling tower vapor can become a problem on the adjacent streets and highways, if the atmospheric conditions are right and the construction of the tower is not proper. The GEA Air-cooled system is suitable for unusually water scarce areas. It conducts the exhaust steam from the turbine, through large ducting, directly to a header. This minimizes power consumption and prevents freezing problems during cold weather or light load operation. (See also W71-02478) (Upadhyaya-Vanderbilt)
W71-02486

ECONOMIC CONSIDERATIONS IN THERMAL DISCHARGE TO STREAMS,
Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
For primary bibliographic entry see Field 05G.
W71-02488

SUMMARY AND STATUS OF THE ART,
Vanderbilt Univ., Nashville, Tenn. Dept. of Environmental and Water Resources Engineering.
Frank L. Parker, and Peter A. Krenkel.

In: Engineering Aspects of Thermal Pollution, Chapter 11, p 313-328, 1969.

Descriptors: *Thermal pollution, *Cooling water, Stratified flow, Temperature, Ecology, Fishkill.
Identifiers: Electric generating capacity, Magnetohydrodynamic power generation (MHD), Cooling devices.

Analysis of steam-electric cooling discharges for 1965 indicates an average 13F rise in water temperatures after passing through the condensers. The amount of water withdrawn for this purpose is approximately 42 trillion gallons per year, which is roughly 10% of total flow of water in the U. S. The electric generating industry is doubling in magnitude every 10 years. We can expect that the thermal problems associated with cooling water discharges from steam-electric generating plants will even further exceed the problems from industrial sources, because it appears that industrial plants have, by and large, already reached the maximum economically efficient size. The best efficiencies for present day fossil-fueled plants are about 40% and for light-water reactors about 34%. The MHD systems with single cycles can achieve thermal efficiencies of 50 55%, which possibly could be boosted to 60 to 70% by using a binary cycle. If a binary cycle using a gas turbine is utilized, the thermal pollution problem is avoided entirely. Another possibility for central station generation of electricity is by controlled thermonuclear fusion. Of all the effects of the increased heat to our streams, possibly the most striking is the induction of stratified flow by the discharge of these warmed waters to surface streams, reducing the waste-assimilative capacity of the stream, changing the algal population, and causing chemical reactions to proceed at a faster rate. (See also W71-02478 and W70-05059) (Upadhyaya-Vanderbilt)
W71-02490

BIOLOGICAL ASPECTS OF THERMAL POLLUTION.
Vanderbilt Univ., Nashville, Tenn. Dept. of Environmental and Water Resources Engineering.
For primary bibliographic entry see Field 05C.
W71-02491

ENGINEERING ASPECTS, SOURCES, AND MAGNITUDE OF THERMAL POLLUTION,
Vanderbilt Univ., Nashville, Tenn. Dept. of Environmental and Water Resources Engineering.
For primary bibliographic entry see Field 05B.
W71-02492

REGIONAL WATER AND SEWERAGE FACILITIES PLAN 1990.
Indian Nations Council of Governments, Tulsa, Okla.

Available from NTIS as PB-194 141, $3.00 in paper copy, $0.95 in microfiche. Report to Indian Nations Council of Governments, April 1970. 186 p. HUD Oklahoma P-117.
Identifiers: *Regional planning, *Oklahoma, *Water supply, Urban areas, *Sewage, Environmental engineering, Demography, Land use, Management methods, Financing, Creek County (Okla), Osage County (Okla), Rogers County (Okla), Tulsa County (Okla), Indian Nations Council of Governments, Capital improvements.

The purposes of the study are: To prepare a regional plan which will aid in the development and maintenance of water supply and waste disposal facilities and thereby assist in the provision of healthful living conditions; to assist to orderly land use change, relationships, and development; and to qualify the region for financial assistance for the construction of water and sewage facilities. The water and sewage plan is based upon guidelines concurrently being developed by the Indian Nations Council of Governments (INCOG).
W71-02611

THE INFLUENCE OF AERATION ON THE COMPOSTING OF POULTRY MANURE-GROUND CORNCOB MIXTURES,
Guelph Univ. (Ontario). Dept. of Microbiology.
R. G. Bell.
Journal of Agricultural Engineering Research, Vol 15, No 1, p 11-16, 1970. 5 fig, 2 tab, 8 ref.

Descriptors: *Farm wastes, *Aeration, *Poultry, Laboratory tests, Odor, Salmonella sp., Temperature, Depth, Microorganisms, Waste water treatment.
Identifiers: *Composting, Corncob mixtures, Canada, Microbial activity.

The influence of the rate of aeration on 1.5m colums of composting mixtures of 2 parts poultry manure and 1 part ground corncob was investigated. The results indicate that the optimum aeration rate for the production of a stable sanitary compost was 4 liters of air/m2/min for every 10 cm. of composting material up to a maximum depth of about 2.4 m. A detailed discussion of the materials, methods and results is presented. (Christenbury-Iowa State)
W71-02683

ENGINEERING ANALYSIS OF CATTLE FEEDLOTS TO REDUCE WATER POLLUTION,
Texas Technological Coll., Lubbock. Dept. of Civil Engineering.
W. Grub, R. C. Albin, D. M. Wells, and R. Z. Wheaton.
Transactions of the American Society of Agricultural Engineers, Vol 12, 1969, p 490-492, 495. 2 tab, 5 fig, 3 ref.

Descriptors: *Farm wastes, *Cattle, *Water pollution sources, Runoff, Precipitation, Nitrogen, Phosphorus, Biochemical oxygen demand, Slopes, Surfaces, Feeds, Silage, Management, Design, Waste water treatment.
Identifiers: *Feedlots, *Ration composition, Feedlot layout, Waste accumulation.

Incorporating both engineering and biological aspects, this report contains an analysis of data and suggests management and design practices that could reduce materially the pollution contributed by the confined land area where feeder cattle are maintained. The study was conducted in two phases. The first phase was concerned with the waste accumulation on the feedlot surface as influenced by ration. The second phase of the project was concerned with determining the quality of liquid runoff as related to the rations fed to cattle, as related to the time of accumulation of the manure pack. For the first phase, ration composition, its effect on quantity of excretion, and changes in the accumulated wastes are looked at. For the second phase, the effects of precipitation, surfacing material, land slope, depth of waste accumulation, feedlot layout, and ration composition are evaluated. Nitrogen, phosphorus and BOD were used as measures of pollution. (White-Iowa State)
W71-02685

TREATMENT AND DISPOSAL OF ANIMAL WASTES,
Cornell Univ., Ithaca, N.Y.
Raymond C. Loehr.
Industrial Water Engineering. Vol 7, No 11, p 14-18, November 1970. 3 fig.

Descriptors: *Farm wastes, Lagoons, Drying, Nutrients, Disposal, Inorganic compounds, Nitrogen, Phosphorus, Nitrification, Denitrification, Confinement pens, Waste water treatment.
Identifiers: Holding tanks, In-house ditches, Oxidation ditches, Separation of wastes, Composting, System.

Due to confinement feeding of livestock it has become doubtful from the profit standpoint to recycle manure by applying it to land. There has been an increase of 120% in the number of cattle of feed in the last 15 years. Laws are being considered which make it mandatory to reduce the pollution potential of livestock waste. The nine most feasible systems for animal waste disposal are discussed. These systems utilize either holding tanks, in-house ditches, separation of wastes, or drying and composting. These systems will remove most of the organic-oxygen-demanding material but not the inorganic nutrients. Land disposal has been effective for disposal of phosphorous. However land disposal for nitrogen may not be adequate. Two techniques for reducing the nitrogen load in animal waste is through ammonia release and the nitrification-denitrification cycle. (Christenbury-Iowa State)
W71-02688

USE OF SOIL TO TREAT ANAEROBIC LAGOON EFFLUENT RENOVATION AS A FUNCTION OF DEPTH AND APPLICATION RATE,
Iowa State Univ., Ames. Dept. of Agricultural Engineering.
J. K. Koelliker, and J. R. Miner.
Transactions of the American Society of Agricultural Engineers, Vol 13, No 4, p 496-499, July-August 1970. 3 fig, 4 tab, 19 ref.

Descriptors: *Denitrification, *Nitrogen, *Irrigation, Farm wastes, Chemical oxygen demand, Lagoons, Nitrates, Nitrites, Ammonia, Bacteria, Treatment, Disposal, Anaerobic conditions, Waste water treatment.
Identifiers: *Nitrogen balance, Nitrobacter, Nitrosomonas, Lagoon effluent, Application rates.

This paper reports the findings from a study where lagoon effluent was applied to soil for final treatment. The active soil profile appears to offer great potential as a final treatment media for partly treated animal wastes. Anaerobic livestock-lagoon effluent sprinkled on grass-covered soil profile reduced the COD, phosphorous, and nitrogen concentrations 95, 99, and 80 percent, respectively in 3 months. Loading range was 13.9 to 30.5 in. of lagoon effluent. Removal of COD was attributed to biological activity and physical filtration in the upper inches of soil. Phosphorus reduction resulted from chemical activity of the clay fraction near the soil surface. Nitrogen reduction was attributed primarily to dentrification in the soil profile. It was recommended that if nitrogen reduction is a goal in waste water disposal, a rather wet schedule should be followed. The applied waste water should contain some organic load so that a substrate will be provided for the denitrifying bacteria. (Christenbury-Iowa State)
W71-02689

BIO-OXIDATION OF SWINE WASTE BY THE ACTIVATED-SLUDGE PROCESS,
Iowa State Univ., Ames. Dept. of Agricultural Engineering.
Ronald E. Hermanson, Thamon E. Hazen, and Howard P. Johnson.
Transactions of the American Society of Agricultural Engineers, Vol 12, No 3, 1969, p 342-348. 5 fig, 1 tab, 19 ref.

Descriptors: *Farm wastes, *Hogs, *Activated sludge, *Model studies, Anaerobic conditions, Farm lagoon, Regression analysis, Least squares method, Biochemical oxygen demand, Aeration, Settling basins, Nitrogen, Temperature, Effluent, Dissolved oxygen, Hydrogen ion concentration, Waste water treatment.
Identifiers: *Extended aeration, BOD-reduction efficiency, Mixed liquor, Aeration tank, Suspended solids.

The purpose of this research was to investigate the extended-aeration, activated-sludge process of swine waste treatment. Two objectives were: (1) to develop a mathematical model for the BOD-reduction efficiency of the process, and (2) to verify the model and evaluate its coefficients by conducting experiments with a laboratory-scale plant. The components of the activated-sludge treatment plant were as follows: (1) an aeration tank; (2) an

aeration system; (3) a sedimentation tank; and (4) a mechanism for returning settled activated sludge to the aeration tank. The experimental model was comprised of an aeration tank and a sedimentation tank made of Plexiglas, with two galvanized sheet metal sedimentation tanks as alternates. Three capacities were required in the sedimentation section to provide suitable detention times over the range of flow rates used. The following conclusions resulted from this research. (1) Effluent from an anaerobic lagoon is sufficiently constant to be a practical influent substrate for model studies. (2) Excessive solids loss because of denitrification can be avoided by proper design of the sedimentation tank, provided the flow rate does not vary widely. (3) The mathematical model satisfactorily predicted the BOD-reduction efficiency of an extended-aeration, activated-sludge plant, as evidenced by the reasonably high multiple r2 (0.92) and the low standard error (2.6 percent) of the experimental regression equation. (4) The aeration tank of an extended-aeration activated-sludge plant for the treatment of the effluent from an anaerobic swine lagoon designed according to the equation developed. (White-Iowa State)
W71-02693

UNDER-CAGE MANURE DRYING SYSTEM SOLVES ODOR PROBLEMS,
Cloisterdale Farms, Ephrata, Pa.
Glenn H. Herr.
Farm Service Bulletin, July-August, 1970. Poultry Digest, Vol 29, No 344, p 476-479, October 1970. 4 fig.

Descriptors: *Farm wastes, *Poultry, *Odors, *Aeration, *Disposal, Economics, Aerobic conditions, Forced drying, Liquid wastes, Drying, Lagoons, Anaerobic bacteria, Costs, Waste water treatment.
Identifiers: *Stirring, Odor-causing bacteria, Semi-dry manure.

This paper deals with the problems and their solutions encountered by a commercial poultry farm with odors and waste management. The various systems that were tried unsuccessfully are discussed. Their solution was one developed by Dr. Glenn Bressler and co-workers at Pennsylvania State University for drying the manure. The system employs a stirring device and forced air to keep the manure aerobic. The manure is dried to one-third its original weight which has eliminated many of their disposal problems. The cost of the system is discussed. (Christenbury-Iowa State)
W71-02696

POULTRY MANURE LAGOON DESIGN,
California Univ., Davis. Agricultural Extension Service.
Robert A. Parsons, Fred Price, and W. C. Fairbank.
Poultry Digest, Vol 29, No 344, p 485-488, October 1970. 6 fig.

Descriptors: *Farm wastes, *Poultry, *Lagoons, *Design criteria, *Odor, Cleaning, Recirculated water, Costs, Anaerobic conditions, Anaerobic bacteris, Aerobic conditions, Aerobic bacteria, Aeration, Waste water treatment.
Identifiers: *Flushing gutter, Macerated chicken carcasses, Floating debris, V-trough, Washout system, Overload, Malfunctions, Gutter design, Thiopedea roses.

This paper deals with lagoon design criteria for poultry manure. A lagoon is a satisfactory means of poultry manure disposal. The lagoon should be used only in rural areas that are tolerant of varied but dilute odors of farm production. Overloading is about the only cause of lagoon malfunction. Size requirements, construction, flushing system, and lagoon operation are discussed. (Christenbury-Iowa State)
W71-02700

ANIMAL WASTE MANAGEMENT.
Cornell Univ., Ithaca, N.Y.

R. C. Loehr, Editor. In: Animal Waste Management, Proceedings Cornell University Conference on Agricultural Waste Management, January 13-15, 1969. 414 p.

Descriptors: *Farm wastes, *Hogs, *Cattle, *Water pollution, *Air pollution, Soil contamination, Rates of application, Poultry, Sheep, Biochemical oxygen demand, Chemical oxygen demand, Dissolved oxygen, Hydrogen ion concentration, Oxidation Lagoons, Lagoons, Aeration, Soils, Moisture content, Fertilizers, Nitrogen, Phosphorus, Potash, Economics, Legal aspects, Legislation, Water quality act, Water table, Odors, Rotors, Aerobic conditions, Anaerobic conditions, Digestion, Antibiotics, Irrigation, Oxygen, Rotations, Hydrology, *Waste water treatment.
Identifiers: *Oxidation ditch, Land disposal, *Feedlots, *Confinement, Population equivalent, Slatted floors, Decomposition.

The increase in high density confined animal production operations in the past decade has led to a number of environmental quality problems, such as air and water pollution. The 1969 Conference attempted to bring knowledgeable individuals from many disciplines together to mutually discuss various aspects and potential solutions to the animal waste management problem. Forty-six papers, reports, and speeches are presented in the proceedings. Such diverse topics as hydrology, economics, odor measurement, lagooning, aerobic digestion, and land disposal are presented. Research and studies in many fields are reported. (White-Iowa State)
W71-02701

EFFECTS OF WATER QUALITY STANDARDS ON THE REQUIREMENTS FOR TREATMENT OF ANIMAL WASTES,
Federal Water Pollution Control Administration, Washington, D.C.
For primary bibliographic entry see Field 05G.
W71-02704

THEORY AND FUTURE OUTLOOK OF ANIMAL WASTE TREATMENT IN CANADA AND THE UNITED STATES,
Toronto Univ. (Ontario). Dept. of Civil Engineering.
P. H. Jones.
In: Animal Waste Management, Proceedings Cornell University Conference on Agricultural Waste Management, 1969, p 23-36. 2 tab, 27 ref.

Descriptors: *Farm wastes, *Biochemical oxygen demand, *Biological treatment, *Oxygen, Water pollution, Nitrogen, Odors, Carbon, Waste water treatment, Aeration, Aerobic treatment, Anaerobic digestion.
Identifiers: Pollution potential, Waste characteristics, Integrated farming, Aerobic composting.

This paper presents some of today's theories on waste treatment and their effectiveness, both socially and physically. The paper tells of the pollution potential and characteristics of animal waste, as well as some of the waste treatment objectives. Theoretical formulas are presented for the introduction of oxygen into an aqueous system, and the reduction of BOD. Potential solutions to the waste treatment problem are listed and summarized as follows: integrated farming, anaerobic holding, aerobic systems, complete treatment, anaerobic digestion, drying and incineration, and aerobic composting. Research needs are given, as well as a look to the future for what may be possible. (White-Iowa State)
W71-02706

DESIGN PARAMETERS FOR THE STABILIZATION OF HIGHLY ORGANIC MANURE SLURRIES BY AERATION,
Rutgers - The State Univ., New Brunswick, N.J. Dept. of Environmental Sciences.
Albert F. Vickers, and Emil J. Genetelli.
In: Animal Waste Management, Proceedings Cornell University Conference on Agricultural Waste Management, 1969, p 37-49. 7 fig, 6 tab, 11 ref.

Descriptors: *Farm wastes, *Poultry, *Aerobic treatment, *Biochemical oxygen demand, Dissolved oxygen odor, Waste water treatment.
Identifiers: Aerobic stabilization, Manure slurry, Ultimate disposal, Loading parameter, Suspended solids.

It has been determined in this research that aerobic stabilization basins are not suitable for the complete treatment of slurries of poultry manure. However, the aerobic stabilization basins do provide satisfactory pretreatment prior to ultimate disposal. This treatment provides sufficient stabilization of the manure to eliminate nuisance problems when ultimately disposed of on land. The critical loading parameter determined in this bench scale system is a volume loading of 60 cubic feet of aeration basin per pound of applied BOD in the manure slurry. The average BOD reduction in the unsettled effluent was 87% with an average solids destruction of 53%. Foaming difficulties were encountered after the critical loading parameter determined was exceeded. (White-Iowa State)
W71-02707

SWINE WASTES, CHARACTERIZATION AND ANAEROBIC DIGESTION,
Kansas Agricultural Experiment Station, Manhattan.
Lawrence A. Schmid, and Ralph I. Lipper.
In: Animal Waste Management, Proceedings Cornell University Conference on Agricultural Waste Management, 1969, p 50-57. 4 tab, 2 fig, 3 ref.

Descriptors: *Farm wastes, *Anaerobic digestion, Swine, Biochemical oxygen demand, Chemical oxygen demand, Methane, Odor, Waste water treatment.
Identifiers: *Digester, Waste digestion, Feed ration.

Laboratory and field tests were undertaken to show the effectiveness of anaerobic digestion as a possible solution to swine waste treatment. The following conclusions are made from the study: (1) The waste characteristics can be related to pounds of waste per unit pound of live weight. (2) If organic removal is the desired objective, it can best be done by solids removal from the fresh wastes resulting in COD reductions of 90%. (3) Mixing is required in the anaerobic digestion phase to disperse the fresh waste. (4) Normally, the efficiency of anaerobic treatment can be increased by increasing the solids retention time. (5) Results have shown that conventional anaerobic digestion cannot be practiced on raw undiluted hog wastes which include the urine. (6) Digestion only for liquifaction does not require the close environmental control required to stimulate growth of methane bacteria. (7) Design for the objective of waste liquifaction for the purpose of reuse as flushing water, ultimate disposal on land, and ease of handling can be one answer to the problem of handling and treatment of wastes from confinement feeding of swine. (White-Iowa State)
W71-02708

AEROBIC DECOMPOSITION OF SOLID WASTES FROM CATTLE FEEDLOTS,
Texas Technological Coll., Lubbock. Dept. of Civil Engineering.
D. M. Wells, R. C. Albin, W. Grub, and R. Z. Wheaton.
In: Animal Waste Management, Proceedings Cornell University Conference on Agricultural Waste Management, 1969, p 58-62. 4 fig.

Descriptors: *Farm wastes, *Moisture content, Cattle, Temperature, Nitrogen, Phosphorus, Waste water treatment.
Identifiers: *Aerobic stabilization, *Composting process.

This is a progress report on research being conducted on the aerobic stabilization of solid beef feedlot wastes and is concerned with the composting process and with the effect of feed, management, and climate on waste stabilization. Two general areas were reported in the paper, one concerned with composting in open air piles and the other with composting in a specially built drum type digester. Forty per cent reductions in volume and 20% losses in dry matter were noted. The most rapid rate of stabilization seemingly takes place during the first few days of the process, with a steady decrease in the rate of stabilization occurring with time. (White-Iowa State)
W71-02709

ANALYSIS FOR OXYGEN TRANSFER COEFFICIENTS IN ROTOR AERATION SYSTEMS,
Oklahoma State Univ., Stillwater. Dept. of Agricultural Engineering.
John J. Kolega, Gordon L. Nelson, and Quintin B. Graves.
In: Animal Waste Management, Proceedings Cornell University Conference on Agricultural Waste Management, 1969, p 63-75. 9 fig, 4 tab, 13 ref.

Descriptors: *Farm wastes, *Equations, Oxygen, Dissolved oxygen, Oxygenation, *Model studies, Waste water treatment.
Identifiers: *Rotor aerator, *Oxidation ditch, Oxygen transfer.

The laboratory method described presents a technique for use in the engineering design and analysis of a horizontal rotor aerator system in livestock waste management. This procedure can be used to obtain quantitative prediction equations to estimate the oxygen transfer coefficients for a selected range of operating conditions. Once the prediction equation for a given system is developed, it can be further used to evaluate new applications provided the parameters fall within the range of the predicted equation developed. An equation for estimating the oxygen transfer coefficients per revolution of rotor was obtained with a model rotor aerator using distilled water as the liquid. Rotor aerator performance curves illustrating how the prediction equation can be used in livestock waste system design and management were also developed. (White-Iowa State)
W71-02710

AEROBIC STORAGE OF DAIRY CATTLE MANURE,
Purdue Univ., Lafayette, Ind. School of Civil Engineering.
Don E. Bloodgood, and C. M. Robson.
In: Animal Waste Management, Proceedings Cornell University Conference on Agricultural Waste Management, 1969, p 76-80. 2 tab, 1 fig, 4 ref.

Descriptors: *Farm wastes, Cattle, Aeration, Temperature, Odor, Chemical oxygen demand, Waste water treatment.
Identifiers: Dairy cattle, Loading rates, Kjeldahl nitrogen, Degradation, Volatile solids.

Laboratory tests with seven liter, aerated containers were performed in 4C and 24C rooms. Loading rate of 60, 80, 100, and 120 grams of wet raw dairy manure per day were used at both temperatures. Conclusions were made from the results of the experiment as follows. (1) The amount of leading does not influence the degree of degradation that takes place. (2) The tests indicate a decrease in volatile solids of 20 per cent at 4C and 42 per cent at 24C. (3) Appreciable amounts of material with a COD are removed in the aerobic storage process. (4) The Kjeldahl nitrogen concentration of material remaining after aerobic storage is higher after the storage period. (5) Foaming is a real problem in the aerobic storage of manure from dairy cattle. (6) Aerobic storage of manure from dairy cattle has promise of minimizing the odor problem encountered in the spreading of unaerated material after storage. (White-Iowa State)
W71-02711

AEROBIC DIGESTION OF DILUTED ANIMAL MANURE IN CLOSED SYSTEMS - TEMPORARY EXPEDIENT OR LONG RANGE SOLUTION,
Massachusetts Univ., Amherst. Dept. of Civil Engineering.
J. T. Clayton, and T. H. Feng.
In: Animal Waste Management, Proceedings Cornell University Conference on Agricultural Waste Management, 1969, p 81-87. 6 fig, 1 ref.

Descriptors: *Farm wastes, *Aerobic treatment, *Anaerobic digestion, *Effluents, Cattle, Biochemical oxygen demand, Nitrates, Hydrogen ion concentration, Waste water treatment.
Identifiers: *Sedimentation tanks, *Degradation, Volatile solids.

The pilot scale manure treatment system studied was an adapted composite of two aerobic-anaerobic dairy manure treatment systems. It was designed to process the waste of one mature dairy cow, together with the water necessary to flush the manure from the barn. The system consisted of a 2000 gallon primary sedimentation tank, a 1000 gallon aeration tank, and a 200 gallon final sedimentation tank. The effluent was collected and analyzed at three different points in the closed system. Graphs of total solids, volatile solids, pH, BOD, and nitrate content versus time are given for the three effluent collection points. The overall objective was to design a system the effluent from which could be used as a flushing and transport medium for subsequent cleanings of a dairy cow housing facility, or be discharged into a water course. (White-Iowa State)
W71-02712

INFLUENCE OF CHEMICAL TREATMENTS UPON DIGESTIBILITY OF RUMINANT FECES,
Agricultural Research Service, Beltsville, Md. Animal Husbandry Research Div.
L. W. Smith, H. K. Goering, and C. H. Gordon.
In: Animal Waste Management, Proceedings Cornell University Conference on Agricultural Waste Management, 1969, p 88-97. 10 tab, 11 ref.

Descriptors: *Farm wastes, *Cattle, *Digestion, Sheep, Orchardgrass, Alfalfa, Ruminants, Waste water treatment.
Identifiers: Sodium hydroxide, Sodium peroxide, In vitro fermentation, Chemical treatment.

Sodium hydroxide and sodium peroxide treatment of orchardgrass and alfalfa cow feces resulted in large decreases in the cell wall (CW), cellulose, hemicellulose, and lignin contents. Treatment with sodium chlorite changed composition little except for a large reduction in lignin content. True CW digestibility was increased several fold by each treatment as measured by an in vitro fermentation technique. Corn silage rations containing 25% of the total dry matter (DM) as either untreated or 3% sodium peroxide treated orchardgrass feces were consumed equally well as an all corn silage ration by sheep. Lower intake was observed for a corn silage ration which contained 50% similarly treated feces also on a dry matter basis. Digestibility coefficients for the various components of the feces portion of the rations were calculated by difference. Addition of 3% sodium peroxide to feces increased average DM, 29; nitrogen, 25; CW, 55; cellulose, 41; and hemicellulose, 90 digestibility units over that of the untreated feces. Neither concentration nor molar ratios of ruminal volatile fatty acids changed due to the inclusion of treated or untreated feces in rations for sheep. (White-Iowa State)
W71-02713

THE VALUE OF HYDROLYZED AND DRIED POULTRY WASTE AS A FEED FOR RUMINANT ANIMALS,
Pennsylvania State Univ., University Park.
T. A. Long, J. W. Bratzler, and D. E. H. Frear.
In: Animal Waste Management, Proceedings Cornell University Conference on Agricultural Waste Management, 1969, p 98-104. 12 tab.

Descriptors: *Farm wastes, *Feeds, *Nitrogen, Poultry, Cattle, Sheep, Waste water treatment.
Identifiers: *Hydrolyzed poultry waste, Rations, Feedlot performance, Digestion coefficient, Carcass characteristics.

Information was presented concerning the value of heat treated poultry waste as a source of nutrient for ruminant animals. In a metabolism trial, whethers were fed a semi-purified ration in which the nitrogen was supplied by hydrolized poultry waste, cooked poultry waste, or soybean oil meal. The digestion coefficients for crude protein differed significantly (PA.05) between all rations. Nitrogen excreted in the feces was significantly lower for the soybean oil meal ration than for the poultry waste ration. No other significant differences were observed. It was found in a fattening trial with steers that rate of gain, feed efficiency, and carcass grade were not significantly different for beef steers fed rations in which the supplemental nitrogen was supplied as soy bean oil meal, hydrolized poultry waste or dried poultry waste. Rate of gain was higher (PA.05) for the steers fed the ration containing urea. The treated poultry waste rations were readily consumed by the steers and no undesirable effect on carcass characteristics were found. (White-Iowa State)
W71-02714

CATTLE MANURE: RE-USE THROUGH WASTELAGE FEEDING,
Alabama Agricultural Experiment Station, Auburn.
W. Brady Anthony.
In: Animal waste Management, Proceedings Cornell University Conference on Agricultural Waste Management, 1969, p 105-113. 9 tab, 1 fig, 10 ref.

Descriptors: *Farm wastes, *Cattle, Feeds, Performances, Waste water treatment.
Identifiers: *Wastelage, Yeast fermentation.

Manure collected daily from a concrete floor of a pen housing steers was blended with a fattening feed in the ratio of 2:3. The wastelage system was developed for more flexibility. Wastelage is the combining of fresh manure with ground grass hay in the ratio of 57:43 with storage in a silo until fed. Five conclusions were drawn from the study. (a) Fresh feedlot manure can be mixed with concentrate and fed successfully to cattle with a considerable saving in feed used per unit of beef produced. (b) Wastelage represents a flexible system of removing manure daily, blending it with hay, and storing as silage. (c) Elimination of pollution from steer feedlots can be obtained through use of the wastelage plan. (d) Yeast can be produced on fluidized and aerated manure. About 68% of manure dry matter appears recoverable in the yeast fermentation product. (e) Feedlot manure properly handled is a valuable product for conversion to an animal feed. (White-Iowa State)
W71-02715

SPECIFICATIONS FOR EQUIPMENT FOR LIQUID MANURE DISPOSAL BY THE PLOW-FURROW-COVER METHOD,
Rutgers - The State Univ., New Brnuswick, N.J. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 05E.
W71-02716

USE OF POULTRY MANURE FOR CORRECTION OF Zn and Fe DEFICIENCIES IN PLANTS,
Colorado State Univ., Fort Collins. Dept. of Agronomy.

B. F. Miller, W. L. Lindsay, and A. A. Parso.
In: Animal Waste Management, Proceedings Cornell University Conference on Agricultural Waste Management, 1969, p 120-123. 2 tab, 6 ref.

Descriptors: *Farm wastes, *Fertilizers, Poultry, Iron, *Corn, Waste water treatment.
Identifiers: *Micronutrient deficiency, Zinc.

A greenhouse study was conducted with corn on a soil deficient in available Zn and Fe. Fifteen fertilizer combinations including N,P, Zn, Fe, poultry manure and poultry manure ash were used. Adequate K was supplied by the soil. The results of this study are interpreted as showing that poultry manure is beneficial for the correction of Zn and Fe deficiencies. This benefit is supplementary to its value as an NPK fertilizer. Furthermore, the organic fraction of poultry manure is important in rendering Zn and Fe more available to plants. This beneficial effect is greater in the case of Fe than Zn, but it is significant in both cases. The findings of this study support the hypothesis that manure and other organic wastes may either supply or give rise to natural chelating agents that aid in the solubilization of insoluble micronutrient elements in soil and thereby render them more available to plants. (White-Iowa State)
W71-02717

THE NITROGEN PROBLEM IN THE LAND DISPOSAL OF LIQUID MANURE,
Guelph Univ. (Ontario). Dept. of Soil Science.
For primary bibliographic entry see Field 05B.
W71-02718

STATUS REPORT ON WATER POLLUTION CONTROL FACILITIES FOR FARM ANIMAL WASTES IN THE PROVINCE OF ONTARIO,
A. R. Townshend, K. A. Reichert, and J. H. Nodwell.
In: Animal Waste Management, Proceedings Cornell University Conference on Agricultural Waste Management, 1969, p 131-149. 14 tab, 5 fig, 9 ref.

Descriptors: *Farm wastes, *Water pollution control, Cattle, Hogs, Poultry, Lagoons, Waste water treatment.
Identifiers: *Population equivalent, *Confinement housing, Pollution potential, Concentrations, Land disposal, Oxidation ditch.

Farm animal waste problems of the agricultural industry in Ontario are concentrated on the liquid manure water pollution control facilities presently serving swine, beef cattle, dairy cattle, and poultry confinement housing operations. It is concluded that based on present technology and economics, the approach to animal waste disposal in Ontario for the forseeable future should continue to be one of storage and land disposal rather than treatment and effluent discharge to water courses. The status report estimates the pollution potential of farm animal wastes; outlines the present methods of handling liquid manure from confinement operations; tabulates animal waste characteristics, loadings, and population equivalents; gives field data and experiences on typical water pollution control facilities; and concludes with guidelines on the selection, design, and operation of farm waste systems. (White-Iowa State)
W71-02719

DISPOSAL OF DAIRY CATTLE WASTES BY AERATED LAGOONS AND IRRIGATION,
Purdue Univ., Lafayette, Ind. Dept. of Agricultural Engineering.
A. C. Dale, J. R. Ogilvie, A. C. Chang, and M. P. Douglas.
In: Animal Waste Management, Proceedings Cornell University Conference on Agricultural Waste Management, 1969, p 150-159. 11 fig.

Descriptors: *Farm wastes, *Oxidation lagoon, *Sprinkler irrigation, Biochemical oxygen demand, Chemical oxidation demand, Oxidation-reduction potential, Odor, Irrigation, Waste water treatment.
Identifiers: Dairy cattle.

The system studied the aerobic type using a lagoon for storage and treatment but relying solely on sunlight and algae for oxygen. A mechanical surface aerator was used to supply oxygen and for mixing. An overhead sprinkler irrigation system was used in conjunction with the treatment lagoon. The liquid was applied to cropland (grassland) beside the lagoon. Perameters measured included BOD, COD, total solids, volatile solids, pH, and total gallons of influent and effluent; temperature, DO, pH and oxidation-reduction potential of the mixed liquor; distribution of effluent by irrigation; and odor associated with the area. Tentative conclusions were reached as a result of work to date: (a) The system is odorless. (b) The system provides a place to dispose of wastes at all times. (c) Nutrients are saved and are returned to the land. (d) With proper operation, runoff into streams and ditches is minimized. (e) Pollutional characteristics of all wastes are greatly lowered. (f) Cost of installation and operation do not appear to be excessive. (g) A relatively small amount of labor is required. (White-Iowa State)
W71-02720

FIELD TESTS OF OXIDATION DITCHES IN CONFINEMENT SWINE BUILDINGS,
Illinois Univ., Urbana. Dept. of Agricultural Engineering.
Don D. Jones, Donald L. Day, and James G. Converse.
In: Animal Waste Management, Proceedings Cornell University Conference on Agricultural Waste Management, 1969, p 160-171. 15 fig, 1 ref.

Descriptors: *Farm wastes, *Hogs, *Rotors, Oxygen demand, Biochemical oxygen demand, Chemical oxygen demand, Waste water treatment.
Identifiers: *Oxidation ditch, *Confinement buildings, Total solids, Volatile solids.

Tests at the University of Illinois were conducted using two buildings with oxidation ditches. Detention time, rotor speed, rotor immersion, and loading rates were varied. Oxygen demand, solids, BOD and COD were measured periodically and plotted by a digital computer. Problems with foaming and ammonia odor were encountered, but solved by altering the liquid depth and rotor immersion. Apparently the velocity of the waste in the ditch seems to be the controlling factor in oxidation ditch operation. Adequate velocity and oxygenation occurred when the immersion of the aeration rotor into the waste was equal to approximately one-third of the liquid depth. A liquid volume of 200 to 250 cubic feet of ditch volume per foot of rotor length served to maintain a velocity that prevented solids from settling in the ditch. With sufficient gutter volume to give 50 days detention time, the aerobic digestion process can reduce the 5-day BOD of hog waste from approximately 35,000 mg/l to around 3000 mg/l. (White-Iowa State)
W71-02721

STUDY OF THE USE OF THE OXIDATION DITCH TO STABILIZE BEEF ANIMAL MANURES IN COLD CLIMATE,
Minnesota Univ., Minneapolis.
J. A. Moore, R. E. Larson, and E. R. Allred.
In: Animal Waste Management, Proceedings Cornell University Conference on Agricultural Waste Management, 1969, p 172-177. 3 fig.

Descriptors: *Farm wastes, *Climates, *Air temperature, Biochemical oxygen demand, Chemical oxygen demand, Cattle, Rotors, Stabilization, Waste water treatment.
Identifiers: *Oxidation ditch, *Slatted floor.

When loaded at the rate of one animal per 210 cu. ft. of liquid it appears that the oxidation ditch can be operated in cold weather. From results of this trial it can be projected that the oxidation ditch can successfully function to contain and provide minimal treatment to beef cattle wastes in cold climate with the pollutional threat stored until spring. At that time the liquid which is too polluted to be discharged to a waterway might be applied to a receptive soil media for further treatment. The results of a summer operation at a loading rate of one animal per 140 cu. ft. of liquid, indicate that the system achieved an 87% reduction of 5 day BOD. Additional treatment will be required however, because the BOD of the slurry was 22,000 mg/l at the end of the test period. Results indicate that the oxidation ditch system can be used to treat beef waste in climates which experience extended periods of sub-freezing temperatures, although digestion is minimal at these temperatures. Some foaming resulted but was not a limiting parameter. Normal operation has resulted in a low odor level. Sludge buildup was not a problem with an annual cleanout cycle. (White-Iowa State)
W71-02722

CHANGES IN COMPOSITION OF CONTINUOUSLY AERATED POULTRY MANURE WITH SPECIAL REFERENCE TO NITROGEN,
Guelph Univ. (Ontario).
J. B. Edwards, and J. B. Robinson.
In: Animal Waste Management, Proceedings Cornell University Conference on Agricultural Waste Management, 1969, p 178-184. 5 fig, 2 tab, 8 ref.

Descriptors: *Farm wastes, *Nitrogen, Poultry, Aeration, Nitrification, Denitrification, Oxidation-reduction potential, Rotors, Waste water treatment.
Identifiers: *Nitrogen loss, *Oxidation ditch.

The objectives were (a) to study the nitrogen transformation in continuously aerated liquid manure, (b) to determine the most efficient means of eliminating nitrogen from waste (for situations in which sufficient land is not available to meet guidelines for pollution control) and (c) to determine what steps must be taken to prevent losses of nitrogen from liquid manure (for situations in which crop utilization is an integral part of the operation, and sufficient land is available). The study was limited to liquid poultry manure and this report deals, in a preliminary way, with changes in nitrogen components in such waste continuously aerated in both laboratory units and in an oxidation ditch. The results show that the mechanical rotor as operated was not capable of maintaining strictly aerobic conditions in the ditches for more than a few days. In spite of this, odor did not become a problem. From the limited data obtained, the oxidation ditch appears to be a useful device for controlling the ultimate nitrogen content of the manure before land utilization. By encouraging the nitrification-denitrification sequence nitrogen can be removed and, presumably, by inhibiting nitrification, nitrogen could be conserved. (White-Iowa State)
W71-02723

FARM WASTE DISPOSAL FIELD STUDIES UTILIZING A MODIFIED PASVEE OXIDATION DITCH, SETTLING TANK, LAGOON SYSTEM,
Farmland Industries, Inc.
Gerald R. Foree, and Richard A. O'Dell.
In: Animal Waste Management, Proceedings Cornell University Conference on Agricultural Waste Management, 1969, p 185-192. 7 tab, 6 fig, 8 ref.

Descriptors: *Farm wastes, *Hogs, *Lagoons, *Efficiencies, Dissolved oxygen, Biochemical oxygen demand, Chemical oxygen demand, Hydrogen-ion concentration, Waste water treatment.
Identifiers: *Oxidation ditch, *Settling tank, Total solids, Fixed solids, Volatile solids.

The system studied was two buildings, capable of holding 10 sows and litters apiece, located over oxidation ditches. The ditches emptied into a settling tank which in turn emptied into a lagoon. Measurements of dissolved oxygen, temperature, pH, BOD, COD, various solids determinations, various nitrogen determinations, and bacterial quantitation were taken and presented in 7 tables and 5 graphs. The data indicated that the oxidation ditch itself operated at approximately 50% efficiency under optimum operating conditions. The total system

ditch, settling tank and lagoon appeared to operate between 70 and 90 per cent efficiency, depending on the research parameter studied. (White-Iowa State)
W71-02724

CATTLE FEEDLOT WATER QUALITY HYDROLOGY,
Colorado State Univ., Fort Collins. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 05G.
W71-02726

TREATMENT OF WASTES FROM BEEF CATTLE FEEDLOTS - FIELD RESULTS,
Cornell Univ., Ithaca, N.Y.
Raymond C. Loehr.
In: Animal Waste Management, Proceedings Cornell University Conference on Agricultural Waste Management, 1969, p 225-241. 8 fig, 4 ref.

Descriptors: *Farm wastes, *Cattle, *Anaerobic conditions, Alkalinity, Biochemical oxygen demand, Chemical oxygen demand, Ammonia, Nitrates, Nitrites, Rainfall, Water pollution, Digestion, Waste water treatment.
Identifiers: *Feedlots, *Aerobic stabilization, *Polishing unit, *Intermittent loading, Volatile acids, Volatile solids, Total solids, Turbine blower.

Results are presented from a field demonstration study to investigate an anaerobic-aerobic treatment system for beef cattle feedlot waste water, some of the management aspects of such a system are discussed, and data are presented on the quality of runoff from beef cattle feedlots. The demonstration system consisted of a 40,000 gallon anaerobic unit which overflowed into a 15,000 gallon aerobic unit. Aerobic stabilization was accomplished by means of a turbine blower and a simple diffuser system. The effluent from the aeration unit flowed to a polishing unit which provided for separation of the residual solids. The ability of this system to reduce the pollution from feedlot runoff was demonstrated. The system was able to absorb shock loads of waste that were periodically scraped into the anaerobic unit. The results of the study showed that frequent addition of wastes to the system, frequent mixing of the anaerobic unit, and removal of only a portion of the contents of the anaerobic unit materially assisted the satisfactory performance of the unit and the maintenance of equilibrium conditions. The individual units have been shown to function adequately with a minimum of attention. Further treatment would be required before the effluent could be released to a receiving stream. (White-Iowa State)
W71-02728

MANURE CONSERVATION,
HUPSI Corp., Wabash, Ind.
Robert M. LaSalle, Jr., and Mark Launder.
In: Animal Waste Management, Proceedings Cornell University Conference on Agricultural Waste Management, 1969, p 245-248. 1 fig.

Descriptors: *Farm wastes, *Fertilizers, Poultry, Potash, Air-conditioning, Gross profit, Costs, Dehydration, Waste water treatment.
Identifiers: *Phosphoric acid, Anhydrous ammonia, *Manure conservation.

Tests were conducted in the fall and winter of 1967 on a proposed system of manure conservation. Poultry manure was stabilized and used as a fertilizer rather than going through a bio-degradation process. Troughs were placed under the chickens and a weak phosphoric acid solution flowed by gravity under subsequently lower cage levels and finally into a sump from which it was pumped to the upper most levels. Droppings were immediately stabilized, denatured, and deodorized upon falling into the solution. Additional treatment consists of buffering to reduce the acidity to the proper value for fertilizer and adding potash to increase the potash values to that commensurate with the nitrogen and phosphate analysis for commercial use. Buffering can be done with anhydrous ammonia or potash so that either the nitrogen or potash values are augmented. By these means control is available to bring the final product to any desired fertilizer analysis. An analysis of 10-3-2 can command a price of $61.60 per ton with a gross profit of $14.50 if dehydration is used. By refrigerating the solution flowing under the chickens, the chicken house is completely and perfectly air conditioned. (White-Iowa State)
W71-02730

CAGED LAYER PERFORMANCE IN PENS WITH OXIDATION DITCHES AND LIQUID MANURE STORAGE TANKS,
Guelph Univ., (Ontario). Dept. of Poultry Science.
J. P. Walker, and J. Pos.
In: Animal Waste Management, Proceedings Cornell University Conference on Agricultural Waste Management, 1969, p 249-253. 3 fig, 1 tab, 4 ref.

Descriptors: *Farm wastes, *Poultry, *Performance, Anaerobic conditions, Aerobic conditions, Mortality, Odor, Biochemical oxygen demand, Waste water treatment.
Identifiers: *Oxidation ditch, Feed conversion, Aerator, Population equivalent, Egg production.

The hen housed egg production, feed conversion and mortality performance of caged layers in a pen with oxidation ditches was slightly better than that of caged layers in pens with liquid manure, storage tanks. The odor in the pens with oxidation ditches was less offensive than in the pens with anaerobic storage. Aerators, however, should be installed outside the pen area. The tank design is very important from the standpoint of liquid circulation, and clean-out. A drain to a sump hole for cleaning is essential. The foaming problem, while controlled by commercial anti-foaming agents, limits the practical application of aerators for poultry until a more economical means is found. Cage systems that do not need dropping boards (eg. full stair-steps) should be used; this would eliminate shock loading, reduce odors and labor requirements. (White-Iowa State)
W71-02731

PROBLEMS AND PRACTICES IN SOME SYSTEMS OF MANURE HANDLING IN NORTHERN EUROPE,
Cornell Univ., Ithaca, N.Y. Dept. of Animal Science.
A. M. Meek, W. G. Merrill, and R. A. Pierce.
In: Animal Waste Management, Proceedings Cornell University Conference on Agricultural Waste Management, 1969, p 254-259. 4 fig, 6 ref.

Descriptors: *Farm wastes, *Cattle, *Storage, Odor, Disposal, Waste water treatment.
Identifiers: *Dairy cattle, *Handling system, Slatted floors, Poisonous gases, Agitation, Freestall housing.

Dairy manure handling systems and operations were visited in Scotland, England, Denmark and Sweden. The various types of systems consisted of under-building and outside-underground storage facilities with some type of pump or shuttle agitation system. Many incorporated steel or concrete slatted floors with manure storage pits underneath. Problems of odor and poisonous gases were discussed. A list of 15 safety points for the prevention of gas problems was given. Symptoms of gas poisoning were also listed. (White-Iowa State)
W71-02732

MEASUREMENT OF THE ODOR STRENGTH OF ANIMAL MANURES,
Cornell Univ., Ithaca, N.Y. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 05A.
W71-02733

MICROBIOLOGICAL AND CHEMICAL CHANGES IN POULTRY MANURE ASSOCIATED WITH DECOMPOSITION AND ODOR GENERATION,
Cornell Univ., Ithaca, N.Y. Dept. of Food Science.
William E. Burnett, and Norman C. Dondero.
In: Animal Waste Management, Proceedings Cornell University Conference on Agricultural Waste Management, 1969, p 271-291. 18 fig, 1 tab, 53 ref.

Descriptors: *Farm wastes, *Poultry, *Odor, Aerobic bacteria, Anaerobic bacteria, Ammonia, Hydrogen sulfide, Sulfur bacteria, Waste water treatment.
Identifiers: *Olfactory threshold test, *Odor Intensity Index, *Threshold odor numbers, Uric acid, Odor panel, Volatile organic acids.

Changes in the microbial and chemical composition of batch lots of 'dry' and 'liquid' poultry manure during decomposition were related to the production of offensive odors. The decomposition of uric acid by both aerobic and anaerobic uricolytic bacteria appeared to be related to the formation of significant quantities of ammonia. The number of sulfate-reducing bacteria, including Desulfovibrio species, increased during the course of decomposition of liquid poultry manure. These organisms were implicated as producers of some of the hydrogen sulfide in liquid poultry waste. There were apparent correlations between an increase in odor intensity of liquid manure with increased storage time and the concentrations of volatile organic acids, ammonia, and sulfides. (Miner-Iowa State)
W71-02734

CHEMICAL ASPECTS OF ODOR REMOVAL IN SOIL SYSTEMS,
Washington Univ., Seattle. Dept. of Civil Engineering.
R. C. Gumerman, and D. A. Carlson.
In: Animal Waste Management, Proceedings Cornell University Conference on Agricultural Waste Management, 1969, p 292-302. 6 fig, 1 tab, 7 ref.

Descriptors: *Farm wastes, *Odor, *Hydrogen sulfide, Soil moisture, Waste water treatment.
Identifiers: *Soil filter, *Removal mechanism, Detention time, Reaction temperature.

On the basis of the data presented, it was found possible to postulate mechanisms which describe the removal of hydrogen sulfide species on soil in both wet and dry conditions. Removal of high concentrations of hydrogen sulfide from moving air streams is performed much more efficiently by dry soil than wet. Inter-related parameters which influence the removal of hydrogen sulfide by dry sterile soil are detention time, reaction temperature, amount of hydrogen sulfide entering, concentration of hydrogen sulfide, and the total flow rate. A method of design optimization is presented which determines for a given concentration and influent gas temperature, the total flow rate at which the maximum removal of hydrogen sulfide per unit time results. It is felt this design optimization method should be restricted to air streams containing only hydrogen sulfide, until further research delineates the removal mechanism for other odorous gases. (White-Iowa State)
W71-02735

POULTRY HOUSE DUST, ODOR AND THEIR MECHANICAL REMOVAL,
Harry J. Eby, and G. B. Willson.
In: Animal Waste Management, Proceedings Cornell University Conference on Agricultural Waste Management, 1969, p 303-309. 1 tab, 5 fig, 6 ref.

Descriptors: *Farm wastes, *Poultry, *Odor, *Dusts, Filters, Waste treatment.
Identifiers: Foam pad filters, Clogging.

Tests of plastic foam pad filters as a method of trapping the odor carrying dusts from a poultry

house exhaust fan air stream have shown that foam pads of 10 to 40 pores per square inch are effective. However, the tests show that such pads become clogged with dust in about 6 to 9 hours of operation. Vacuum cleaning and water washing methods of cleaning for continued use were ineffective and the high initial cost of the foam filter material were deemed to make this method impractical. Tests of a device in which the exhaust air is deflected tangentially across a 1/2 inch mesh screen showed that such methods would remove at least a portion of the odor carrying dust. These were also deemed impractical in that the filter ability would appear to be a direct function of the relative humidity and as such would be the least efficient when low relative humidity within the poultry house would make the dust problem the greatest. Other methods of possible filtering techniques were discussed. (White-Iowa State)
W71-02736

CHARACTERISTICS OF AQUEOUS SOLUTIONS OF CATTLE MANURE,
Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
John C. Ward, and E. M. Jex.
In: Animal Waste Management, Proceedings Cornell University Conference on Agricultural Waste Management, 1969, p 310-326. 5 fig, 4 tab, 25 ref.

Descriptors: *Farm wastes, *Cattle, *Aqueous solutions, Biochemical oxygen demand, Dissolved solids, Hydrogen ion concentration, Foaming, Oxidation-reduction potential, Coagulation, Waste water treatment.
Identifiers: *Volatile solids, *Colloidal properties, Activation energy.

The primary objective was to investigate the aqueous characteristics (biochemical oxygen demand, conductivity, pH, oxidation-reduction potential, coagulation and colloidal properties, dissolved solids, volatile solids, and foaming) of solutions of cattle manure containing the combined urine and feces present in samples from cattle feedlots. This information could then be used in the design of facilities for treating runoff from cattle feedlots. It was assumed that treatment of this runoff would probably be by means of lagoons used to capture the runoff, and that these lagoons would be artificially aerated. In this type of aerobic treatment, the biochemical oxygen demand is satisfied in much the same way as in a stream. Formulas were developed and explained and 25 references were utilized. (White-Iowa State)
W71-02737

TYPICAL VARIATIONS ENCOUNTERED IN THE MEASUREMENT OF OXYGEN DEMAND OF ANIMAL WASTES,
Ohio State Univ., Columbus. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 05A.
W71-02738

THE INFLUENCE OF VARIOUS FACTORS ON POULTRY LITTER COMPOSITION,
Pennsylvania State Univ., University Park. Dept. of Animal Science.
F. F. El-Sabban, T. A. Long, R. F. Gentry, and D. E. H. Frear.
In: Animal Waste Management, Proceedings Cornell University Conference on Agricultural Waste Management, 1969, p 340-346. 4 tab, 18 ref.

Descriptors: *Farm wastes, *Poultry, Nitrogen, Carbohydrates, Insulation, Ventilation, Mineralogy, Moisture, Correlation analysis, Nutrients, Waste water treatment.
Identifiers: *Litter composition, *Nutritive value, Dry matter, Crude protein, True protein, Ether extract, Crude fiber.

A study was conducted to determine the chemical composition of poultry waste (litter and manure), relevant to its possible utilization as a source of nutrients. Litter samples were obtained from 33 broiler houses and 22 laying houses. Fresh manure was secured from 5 houses having layers in cages. The dry matter content was determined and samples were analyzed for crude protein, true protein, crude fiber, ether extract, and total ash. In addition, twelve mineral elements were determined. Poultry litter was found to contain considerable amounts of nutrients, particularly nitrogen and carbohydrates. Various factors such as bird type, bird density, kind of litter base material, litter depth, and poultry house conditions (ventilation, insulation, and house temperature) were all found to affect the proximate components of poultry litter. If poultry waste is to be utilized for its nutritive value for plants or animals, it is recommended that each batch be chemically analyzed before use. Although a limited number of samples was available, variation in composition was sufficient to warrant their individual analysis. (White-Iowa State)
W71-02740

REMOVAL OF WATER FROM ANIMAL MANURES,
Cornell Univ., Ithaca, N.Y. Dept. of Agricultural Engineering.
A. T. Sobel.
Animal Waste Management, Proceedings Cornell University Conference on Agricultural Waste Management, p 347-362, 1969. 8 fig, 2 tab, 12 ref.

Descriptors: *Farm wastes, *Poultry, *Moisture content, Odor, Weight, Volume, Humidity, Waste water treatment.
Identifiers: *Equilibrium moisture content, *Relative humidity, Handling characteristics, Volatile solids, Drying times, Thermal removal.

The removal of water from animal manures changes the handling characteristics of the manure, reduces the weight and volume to be handled, and reduces the offensive odor of the manure. Water can be removed from manure by mechanical, thermal, and absorptive means. Mechanical methods such as direct pressing present the difficulty of the removed water containing considerable volatile solids. Thermal removal was investigated from the standpoint of utilizing a thin layer, unheated air, and very low or 'static' air velocity. The equilibrium moisture content of chicken manure is comparable with other agricultural hygroscopic materials. Equilibrium moisture content values are presented for temperatures 70, 90, 110F. Drying times for chicken manure under these conditions is in terms of days. Drying times are greatly influenced by sample variation. Effects of humidity on drying time are significant but sample variation has an effect similar to a plus or minus 15% relative humidity change. Moisture loss from a 'deep' layer of manure is less than that from a free water surface. (White-Iowa State)
W71-02741

RELATIVE ECONOMICS OF ANIMAL WASTE DISPOSAL BY SELECTED WET AND DRY TECHNIQUES,
Resource Engineering Associates, Inc., Stamford, Conn.
Robert W. Okey, Robert N. Rickles, and Robert B. Taylor.
In: Animal Waste Management, Proceedings Cornell University Conference on Agricultural Waste Management, p 369-387, 1969. 5 fig, 17 tab, 11 ref.

Descriptors: *Farm wastes, *Cattle, *Cost analysis, Effluent, Biochemical oxygen demand, Chemical oxygen demand, Odor, Aeration, Nitrogen, Denitrification, Ultimate disposal, Incineration, Waste water treatment.
Identifiers: Wet systems, Dry systems, Effluent standards, Clarifier systems, Biological conversion, Solids conditioning system, Scrubbing system, Ancillary system.

The report presents the basic elements required for the design of two waste treatment facilities to handle the wastes from feedlots carrying 500, 1000, 5,000, 10,000, and 25,000 animals. The plants were designed to meet specified liquid and gaseous effluent standards. The standards selected are believed to be consistent with present and projected effluent requirements. It should be noted that some water courses may not be able to assimilate effluents of the quality discussed here. The two systems designed and costed in this work employed on one hand more or less conventional liquid waste treatment procedures; the other employed incineration and treated the undiluted animal waste as delivered as a solid waste, i.e., sludge. The capital and operational cost of these systems were computed and related to the number of animals and the gain anticipated in the feedlot. A waste treatment cost in terms of animal-years and per pound was then obtained. Five conclusions were reached as a result of the study, among them, that wet systems are more expensive to own and operate than systems designed to handle solids. (White-Iowa State)
W71-02743

THE ECONOMICS OF POULTRY MANURE DISPOSAL,
New York State Coll. of Agriculture, Ithaca.
R. E. Linton.
In: Animal Waste Management, Proceedings Cornell University Conference on Agricultural Waste Management, p 388-392, 1969.

Descriptors: *Farm wastes, *Poultry, *Economics, *Land use, Fertilizers, Nitrogen, Phosphorus, Potash, New York, Disposal, Waste water treatment.
Identifiers: *Land disposal, *Cost calculations, *Waste management, Transportation costs, Catskill resort industry.

This study was initiated in response to the general problem of conflicts over rural land use, particularly those involving farm operations. More specifically and as a notable example, the study dealt with the problems of conflict between poultry and other land uses. The problem of land use conflict related to waste management was approached through the aspect of recognizing the internal costs to farmers of some of the alternatives in waste management. As a result of the study one particular pattern of manure disposal seemed to justify serious consideration and was singled out for discussion and cost calculations. This pattern included some means of land spreading as a practical and acceptable disposal method. Comments were made about the value of poultry manure in replacing commercial fertilizer, and this value is discussed as a means of at least partial disposal cost recovery. (White-Iowa State)
W71-02744

ECONOMIC RETURN FROM VARIOUS LAND DISPOSAL SYSTEMS FOR DAIRY CATTLE MANURE,
Cornell Univ., Ithaca, N.Y.
L. W. McEachron, P. J. Zwerman, C. D. Kearl, and R. B. Musgrave.
Animal Waste Management, Proceedings Cornell University Conference on Agricultural Waste Management, p 393-400, 1969. 11 tab, 13 ref.

Descriptors: *Farm wastes, *Fertilizers, *Rotations, Cattle, Economics, Soil types, Disposal, Waste water treatment.
Identifiers: *Dairy cattle, Land disposal, Continuous corn, Lima silt loam, Manure hauling and spreading, Total digestible nutrients.

Census of Agriculture data are presented to indicate that dairy cattle manure could well be disposed of on the land. Farm cost accounting data are presented to indicate that cost per ton of hauling and spreading averaged $1.92 for farms with free stalls and about 140 cows to $3.18 for those with stanchions and 65 cows. Percent yield increase on crops grown per ton of manure applied range from .4% for oats to 6.6% for alfalfa. These

percent yield increases were generalized without regard to mineral fertilization and applied to Warren's (1968) yield data for the state of New York at various farming levels. Without a charge for hauling and spreading dairy cattle manure crop yield returns ranged from $1.42 per tone to a deficit of $0.26. (White-Iowa State)
W71-02745

ECONOMIC EVALUATION OF LIQUID MANURE SYSTEMS FOR FREE STALL DAIRY BARNS,
Cornell Univ., Ithaca, N.Y. Dept. of Agricultural Economics.
George L. Casler.
In: Animal Waste Management, Proceedings Cornell University Conference on Agricultural Waste Management, p 401-406, 1969. 3 tab.

Descriptors: *Farm wastes, *Economics, *Value, Cattle, Costs, Odor, Fertilizer, New York, Waste water treatment.
Identifiers: *Liquid manure system, *Labor distribution, *Labor requirements, Dairy cattle, Free stall barns.

The purpose was to evaluate liquid manure systems in free-stall dairy barns primarily from an economic viewpoint. If a liquid manure system is to be justified, such justification will have to be based on other advantages in addition to increased manure value and reduced labor requirement. The primary other advantage is the possibility of not hauling manure at periods of peak labor demand for planting and harvesting crops. However, to actually reap the benefits of improved labor distribution, a dairyman needs a reasonably long storage period and must very carefully plan his cleaning schedule. In addition, the very unpleasant odor created at the time the storage tank is emptied precludes the use of a liquid manure system in areas where neighbors would object to this odor. It appears to the author that the air pollution or odor problem is much more serious with a liquid manure system than with daily apreading. (White-Iowa State)
W71-02746

WHO SHOULD REGULATE POULTRY CONFLICT PROBLEMS,
Cornell University, Ithaca, N.Y. Coll. of Agriculture.
David J. Allee, and Pierre Clavel.
In: Animal Waste Management, Proceedings Cornell University Conference on Agricultural Waste Management, p 407-414, 1969. 5 ref.

Descriptors: *Farm wastes, *Poultry, *Technology, Local governments, State government, Odor, Communication, Waste water treatment.
Identifiers: *Regulatory mechanisms, Industry committee, Political resources, Waste management technology, Conflict, Resolution of problems.

Economic and social theory applicable to conflict situations, such as those that arise downstream or downwind from poultry houses, has some ability to indicate directions for administered solutions to these problems. Based upon such theory, related research and a case study of a number of ways in which rural communities have dealt with situations of stress between components of the community, the outlook for regulatory devices is appraised. An informal voluntary industry committee approach is found to be as effective in bringing together necessary technical expertise and social regulatory mechanisms as any other approach which the limited resources of many rural communities can support. It is suggested that because of a shortage of administrative and political resources many rural areas will resist effective resolution of conflict problems due to agricultural wastes until finally controls will be imposed by essentially urban oriented units of government. (White-Iowa State)
W71-02747

BEEF CONFINEMENT SYSTEMS - OXIDATION DITCH,
Minnesota Univ., Minneapolis. Dept. of Agricultural Engineering.
J. A. Moore, R. E. Larson, R. O. Hegg, and E. A. Allred.
Paper No 7331 in the Scientific Journal Series, Minnesota Agricultural Experiment Station; and Paper No 70-418, American Society of Agricultural Engineers, July 1970.

Descriptors: *Farm wastes, *Cattle, Chemical oxygen demand, Biochemical oxygen demand, Ventilation, Rotors, Foaming, Temperature, Hydrogen-ion concentration, Dissolved oxygen, Nitrogen, Ammonia, Waste water treatment.
Identifiers: *Oxidation ditch, Beef cattle, Loading rates, Solids.

The oxidation ditch has been used in Minnesota for two years for treatment of beef cattle wastes. It has been operated as a batch system with various loading rates and environmental conditions. Results are evaluated on the basis of BOD, COS, TS, TVS, pH, nitrogen, temperature of the waste, and odor and foam control. Waste management systems are employed by beef operators to meet certain objectives. These objectives may vary widely depending on such factors as management, labor requirements, climate, size and nature of operation, land availability, soil type and geologic formation and population density. No one waste system is best for all operations. Each system has advantages and disadvantages to offer for any given operation. The oxidation ditch offers the following characteristics: very low odor level, waste storage eliminates runoff, volume reduction of solids, reduction of pollution strength, concentration of some elements, necessity of continuous operation, one of more expensive treatment systems, and a buildup of solids on the bottom. Based on the results obtained from 2 1/2 years of research the authors feel that the oxidation ditch does have a place in treating beef cattle waste from confinement operations. (White-Iowa State)
W71-02748

FARMYARD MANURE HANDLING.
Ministry of Agriculutre, Fisheries and Food, London (England).

Mechanization Leaflet For Farmers and Growers, No 8, December 1965. 6 p.

Descriptors: *Farm waste, *Disposal, *Equipment, Operations, Waste water treatment.
Identifiers: *Machinery, *System, Loaders, Spreaders, Scrapers, United Kingdom.

This leaflet describes the more important types of equipment and working methods used at present in the United Kingdom for farmyard manure handling. Loading and spreading equipment are discussed. Recommendations are made as to the most efficient methods of combining the available men and equipment into an operating system for manure disposal. (Christenbury-Iowa State)
W71-02749

5E. Ultimate Disposal of Wastes

A DESIGN STUDY ON THE ECONOMIC USE OF AGRICULTURAL WASTES IN KANSAS.
Kansas Dept. of Economic Development.

Available from NTIS as PB-194 368, $3.00 in paper copy, $0.95 in microfiche. Kansas Planning for Development Report No 25, Jan 1969. 183 p, 32 tab, 11 fig, 625 ref. HUD Grant to Kansas Department of Economic Development.

Descriptors:
Identifiers: *Agricultural wastes, Utilization, *Waste disposal, Effectiveness, *Economic development, *Kansas, Management planning, Benefit cost analysis, Research projects, Environmental engineering, Water pollution, Control.

The report represents a study of agricultural wastes in Kansas and the technology available for economic utilization. The principal wastes that may provide raw materials for profitable utilization are identified and data on location and quantity of each waste are presented. The most important agricultural waste in Kansas comes from large cattle feedlots. Since disposal is costly to the cattle feeding industry utilization technology is sought to provide raw material for economic development.
W71-02302

DEEP WELL DISPOSAL STUDY FOR BALDWIN, ESCAMBIA AND MOBILE COUNTIES, ALABAMA,
Alabama Geological Survey, University.
Roy M. Alverson.
Alabama Geological Survey Circular 58, 1970. 49 p, 8 fig, 10 plate, 1 tab, 15 ref, append.

Descriptors: *Injection wells, *Waste water disposal, *Industrial wastes, *Alabama, Aquifers, Water pollution control, Permeability, Porosity, Water quality, Hydrologic data, Hydrogeology, Groundwater movement, Stratigraphy.
Identifiers: *Mobile (Ala), *Waste disposal wells.

Baldwin, Escambia, and Mobile Counties, Alabama, have a combined area of 3,817 square miles and a population of 396,900 in the highly industrialized Mobile metropolitan area. The area is underlain by sedimentary rocks of the type used as reservoirs for waste disposal in other parts of the United States. Under certain geologic, hydrologic, and geochemical conditions deep-well injection of liquid industrial waste can be carried out effectively in southwest Alabama. Each proposal, however, must be carefully evaluated, using the criteria outlined in this report to insure against pollution of fresh-water supplies, surface and ground, and protect atainst damage to the environment in the subsurface or at the surface. (Knapp-USGS)
W71-02428

THE VALUE OF HYDROLYZED AND DRIED POULTRY WASTE AS A FEED FOR RUMINANT ANIMALS,
Pennsylvania State Univ., University Park.
For primary bibliographic entry see Field 05D.
W71-02714

CATTLE MANURE: RE-USE THROUGH WASTELAGE FEEDING,
Alabama Agricultural Experiment Station, Auburn.
For primary bibliographic entry see Field 05D.
W71-02715

SPECIFICATIONS FOR EQUIPMENT FOR LIQUID MANURE DISPOSAL BY THE PLOW-FURROW-COVER METHOD,
Rutgers - The State Univ., New Brnuswick, N.J. Dept. of Agricultural Engineering.
Charles H. Reed.
In: Animal Waste Management, Proceedings Cornell University Conference on Agricultural Waste Management, 1969, p 114-119. 8 fig.

Descriptors: *Slurries, *Disposal, Farm wastes, Poultry, Waste water disposal.
Identifiers: *Plow-furrow-cover, Utilization.

A condensation is presented of experimental work that was done on land application of poultry manure slurries. Several pieces of equipment and different operations were looked at. Most incorporated a single bottom 16 in. plow operating 7 in. to 8 in. deep. Manure was deposited in the furrow and then covered. Tank trailers and commercial liquid manure tanks were used to transport and funnel the slurry into the furrow. General performance specifications for plow-furrow-cover equipment is included. (White-Iowa State)
W71-02716

STATUS REPORT ON WATER POLLUTION CONTROL FACILITIES FOR FARM ANIMAL WASTES IN THE PROVINCE OF ONTARIO,
For primary bibliographic entry see Field 05D.
W71-02719

MANURE CONSERVATION,
HUPSI Corp., Wabash, Ind.
For primary bibliographic entry see Field 05D.
W71-02730

PROBLEMS AND PRACTICES IN SOME SYSTEMS OF MANURE HANDLING IN NORTHERN EUROPE,
Cornell Univ., Ithaca, N.Y. Dept. of Animal Science.
For primary bibliographic entry see Field 05D.
W71-02732

THE INFLUENCE OF VARIOUS FACTORS ON POULTRY LITTER COMPOSITION,
Pennsylvania State Univ., University Park. Dept. of Animal Science.
For primary bibliographic entry see Field 05D.
W71-02740

THE ECONOMICS OF POULTRY MANURE DISPOSAL,
New York State Coll. of Agriculture, Ithaca.
For primary bibliographic entry see Field 05D.
W71-02744

ECONOMIC RETURN FROM VARIOUS LAND DISPOSAL SYSTEMS FOR DAIRY CATTLE MANURE,
Cornell Univ., Ithaca, N.Y.
For primary bibliographic entry see Field 05D.
W71-02745

5F. Water Treatment and Quality Alteration

METROPOLITAN WATER SYSTEM OPERATION SUBSEQUENT TO NUCLEAR ATTACK OR NATURAL DISASTER,
Dallas Water Utilities Dept. Tex.
Dan A. Brock.
Available from NTIS as AD-711 956, $3.00 in paper copy, $0.95 in microfiche. Final Report, May 1970. 364 p, 29 tab, 6 fig, 6 ref.

Descriptors:
Identifiers: *Water supplies, Management planning, *Nuclear warfare, Water supplies, Disasters, Mathematical models, Nuclear explosion damage, Vulnerability, Civil defense systems, Power supplies, Post attack operations, *Post attack planning, Computerized simulation, Post attack recovery.

The study develops methodology for creation of a plan for operation of a metropolitan water system subsequent to nuclear attack or natural disaster. Automatic digital computer water system simulation is used to determine the ultimate overall effect of damage to specific components. Vulnerability analyses are made as a mathematical model of the water system reacts automatically to hypothetical attack data supplied by the National Civil Defense Computer Center. Problems of unmanned water purification plant operation are noted. The need for and availability of electric power is considered.
W71-02299

REGIONAL WATER AND SEWERAGE FACILITIES PLAN 1990.
Indian Nations Council of Governments, Tulsa, Okla.
For primary bibliographic entry see Field 05D.
W71-02611

5G. Water Quality Control

POTOMAC-SHENANDOAH RIVER BASIN COMPREHENSIVE WATER RESOURCES PLAN: VOLUME 5-ENGINEERING DEVELOPMENT ALTERNATIVES.
Virginia Dept. of Conservation and Economic Development, Richmond. Div. of Water Resources.
For primary bibliographic entry see Field 06B.
W71-02216

NATIONAL ESTUARY STUDY --- VOLUME 1. MAIN REPORT.
Fish and Wildlife Service, Washington, D.C.
For primary bibliographic entry see Field 02L.
W71-02217

A MODEL RELATING WATER QUALITY, VEGETATIONAL STRUCTURE AND URBANIZATION IN THE SAN JACINTO RIVER BASIN,
Houston Univ., Tex. Dept. of Biology.
David L. Jameson.
Available from NTIS as PB-196 094, $3.00 in paper copy, $0.95 in microfiche. Project Completion Report, December, 1970. 49 p, 11 tab, 2 fig, 8 ref. OWRR Project B-045-TEX (1).

Descriptors: Ecology, *Water quality, *Model studies, *Vegetation, *Urbanization, Texas, Biomass, Statistical models, Probability, Soil analysis, Data processing.
Identifiers: San Jacinto River Basin (Texas), Water quality models, River basin models.

This study was initiated to test the hypothesis that available information was sufficient to predict the relation between amount of urbanization and the quality of the water in the watershed of the San Jacinto River Basin. Chemical water quality measures are the published and unpublished records of the U.S. Geological Survey. Unpublished records of the Houston Water Department provided portions of the Biological Water Quality measures. Predictor variables included soil, weather, population characteristics, and estimates of vegetation type and urbanization obtained from aerial photographs. Factor, discriminant and canonical correlation analyses were used for data reduction. Two models were attempted. The first used the data to construct a matrix model of the relation between predictors and water quality. The second model used a probability distribution of biomasses in the vegetational community to examine the reduction in the community possible without destroying the community and thus destroying the contribution of community to water quality. The results from both models were rejected because of the general incompleteness of the predictor data and because the available predictor data were not directly related to water quality in the areas where data were available. (Jameson-Houston)
W71-02271

INVESTIGATIVE MINE SURVEY OF A SMALL WATERSHED, A FIELD INVESTIGATION TO LOCATE AND DEFINE UNKNOWN OR HIDDEN DRIFT MINE OPENINGS IN THE BROWNS CREEK WATERSHED OF THE WEST FORK RIVER IN WEST VIRGINIA.
Halliburton Co., Duncan, Okla.

Available from NTIS as PB-196 110, $0.95 in microfiche. Available from SOD as: SOD No 167.13/4:14010 DMO 03/70 PC$2.00. Water Pollution Control Research Series 14010 DMO-A, March, 1970. 89 p, 16 tab, 32 fig, 4 ref, append. FWQA Program 14010 DMO, Contract NO 14-12-453.

Descriptors: Drift mining, Mining, Mining engineering, West Virginia, *Strip mines, Mine drainage, Water pollution control, Mine water, Exploration.
Identifiers: Mine surveys, Browns Creek watershed (West Virginia), *Mine openings (Hidden), Auger Probes, Mines drifts, Highwall location (Mines).

The primary purpose of this project was to conduct an investigation to locate hidden or unknown drift mine openings in the Browns Creek Watershed in Harrison County, West Virginia. Thirty unknown openings were discovered in an initial reconnaissance. Additional probing using power driven augers was not successful and was deemed impractical. Three specific areas within the watershed were selected for further scrutiny. The bottom of the highwall line in the strip mined area was determined by land surveyors and this information was plotted on old mine maps to indicate the intersection of the stripping with underground mining. A minimum of 107 mine drifts were shown to be exposed by the 14,500 feet of highwall surveyed in the three areas.
W71-02275

URBAN SOIL EROSION AND SEDIMENT CONTROL,
National Association of Counties Research Foundation, Washington, D.C.
For primary bibliographic entry see Field 04D.
W71-02276

MICROBIAL FACTOR IN MINE DRAINAGE FORMATION,
Mellon Inst., Pittsburgh, Pa.
Robert A. Baker, and Albert G. Wilshire.
Available from NTIS as PB-196 113, $0.95 in microfiche. For sale by the Superintendent of Documents, US Government Printing Office, Washington, DC 20402. Price $0.70 PC Order no 13/4:14010 DKN 11/70. Water Pollution Control Research Series 1410 DKN 11/70, July 1970. 68 p, 12 tab, 22 fig, 36 ref, append. FWQA Program Grant No 14010DKN.

Descriptors: *Mine drainage, Mine acid, Mine wastes, *Mine water, *Acid mine water, Bacteria, *Ferrobacillus, *Thiobacillus, Effluents, Aeration, *Pyrite, Acidic water, *Coal mine wastes, Iron, Sulfate.
Identifiers: *Chemoautrophic microorganisms, Mine models, Algal growth, Ferrobacillus ferrooxidans, Ferrobacillus sulfooxidans, Thiobacillus thiooxidans.

The role of chemoautrophic organisms in the formation of acid mine drainage from pyritic materials associated with coal mining has been investigated by pilot plant techniques. Dynamic flow, controlled environment units which served as models of mines were used. It was demonstrated that the concentration of acidity, ferrous and total iron and sulfate in the effluent from aerobic, biologically-seeded or unseeded pyritic beds is zero order with respect to flow, except at low flow rates where mass transport is diffusion limited. Algal growth occurred in the acidic, aerobic environment but did not affect acid production. Nonaerobic systems produce acidity consisting only of ferrous iron. Total acidity is lower from biologically-seeded than -nonseeded aerobic systems. Acid mine drainage was not significantly affected by seeding with the individual or a mixture of three different organisms but was increased by recycle of the flow and increased appreciably under forced aeration. The rate is directly related to the available pyrite surface area. (Shackelford-FWQA)
W71-02278

COMBATTING SALT-WATER ENCROACHMENT INTO THE BISCAYE AQUIFER--MIAMI, FLORIDA AREA,
Dade County Public Works Department, Miami, Florida.
For primary bibliographic entry see Field 04B.
W71-02283

A DESIGN STUDY ON THE ECONOMIC USE OF AGRICULTURAL WASTES IN KANSAS.
Kansas Dept. of Economic Development.
For primary bibliographic entry see Field 05E.
W71-02302

PROCEEDINGS OF THE NATIONAL CONFERENCE ON SEDIMENT CONTROL.
Dept. of Housing and Urban Development, Washington, D.C. Office of Metropolitan Planning and Development.
For primary bibliographic entry see Field 04D.
W71-02425

A HYDROLOGICAL APPROACH TO CONTROL ACID MINE POLLUTION FOR LAKE HOPE,
Ohio Univ., Athens. Dept. of Geology.
Moid Uddin Ahmad.
Goundwater, Vol 8, No 6, p 19-24, November-December 1970. 6 p, 14 fig, 4 ref.

Descriptors: *Acid mine water, *Water pollution control, *Ohio, *Water pollution sources, *Groundwater movement, Acid streams, Mine acids, Mine drainage, Injection wells, Drainage systems, Subsurface drains, Appalachian Mountain region.
Identifiers: Acid mine drainage, Mine acid control, Vinton County (Ohio).

In the Appalachian region, coal mining has disturbed the natural ground flow system. The mines are continuously being flushed by this disturbed flow system and are producing sulphuric acid. In the McDaniel Mine, Ohio, the flow is lateral and clay layers under the coal do not allow water to leak into the underlying aquifer. Water well logs collected within 10 moles of the Todd Mine show the existence of three separate aquifers. A pilot plan for Todd Mine proposes to discharge the uncontaminated water from the upper aquifer to the lower aquifer, and should stop the flow of water through the mine. This scheme is intended to solve the serious problem of pollution of Lake Hope, Ohio. (Knapp-USGS)
W71-02427

EFFECTS OF LAND MANAGEMENT ON QUANTITY AND QUALITY OF AVAILABLE WATER,
New South Wales Univ., Kensington (Australia). Water Research Lab.
For primary bibliographic entry see Field 04C.
W71-02452

ECONOMIC CONSIDERATIONS IN THERMAL DISCHARGE TO STREAMS,
Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
George O. G. Lof, and John C. Ward.
In: Engineering Aspects of Thermal Pollution, Chapter 10, p 282-301, 1969.

Descriptors: *Thermal pollution, *Cooling water, *Economics, Temperature, Thermal power plants.
Identifiers: *Thermal discharge, Evaporation losses.

The economic consequences of thermal discharge from steam-electric power plants, the largest users of cooling water, are modest increases in operating costs by the downstream users. It is observed that the operating cost of recirculation cooling merely to reduce the temperature of an inlet cooling water supply is greater than the benefit. The annual expense C sub I in cents per thousand gallons of water circulated is given in terms of the cooling tower investment per unit capacity (dollar/gpm); r, the interest rate; t, cooling tower service life (years); P, annual property-taxation rate; and N, the load factor. Costs of operation are functions of R, the cooling range in F; C, the cycles of concentration; Y, alkalinity of make up water; W sub a, cost of make up water; K, the relative rating factor of cooling tower, p, the height to which water must be pumped for flow through the cooling tower (feet); and A, cost of electric power (cents/kwhr). Results of a downstream power plant using warmer condenser water than would naturally have been available are a decrease in total electrical generation and a decrease in thermal efficiency, hence, an increase in costs per kilowatt-hr generated. The net additional cost of powerplant due to such temperature increase, can be expressed in terms of theoretical steam cycle efficiency, turbine generator efficiency, fractional decrease in plant load factor per year, the temperature change in the water steam, present load factor of the plant, the powerplant life, and the natural temperature of cooling water unaffected by thermal discharge upstream. (See also W71-02478) (Upadhyaya-Vanderbilt)
W71-02488

RESEARCH NEEDS FOR THERMAL POLLUTION CONTROL,
Federal Water Pollution Control Administration, Corvallis, Oregon. Pacific Northwest Water Lab.
Bruce A. Tichenor, and William A. Cawley.
In: Engineering Aspects of Thermal Pollution, Chapter 12, p 329-338, 1969.

Descriptors: *Thermal pollution, *Temperature, Ecology, Thermocline, Hypolimnion.
Identifiers: *Research needs, Treatment processes, Non-treatment control technology transfer.

The research needs for thermal pollution control are segmented into transport and behavior of heat in water, and treatment processes and non-treatment controls. More information is needed on what happens when a heated discharge is inserted in either the thermocline or hypolimnion of a stratified reservoir. Other important items are, development of non-empirical, stochastic temperature-prediction models, improvement of the effectiveness of cooling devices for handling large thermal loads and development of methods for effectively utilizing waste heat including industrial and agricultural use. In considering research needs, it is important to recognize that research involves several levels of activities which include, scientific advancement, fundamental development, design and application and technology transfer. Each of three segments of our society, the regulatory agencies, the pollution and the water user should carry a fair share of responsibility. An interdisciplinary research effort to control thermal pollution, calling for the participation of all relevant segments of technical community is needed. (See also W71-02478) (Upadhyaya-Vanderbilt)
W71-02489

YOUNG V INTERNATIONAL PAPER CO (LIABILITY FOR DESTRUCTION OF GROWING TIMBER BY FLOODING).
For primary bibliographic entry see Field 06E.
W71-02567

CONTROL OF ODORS FROM ANIMAL WASTES,
W. E. Burnett, and N. C. Dondero.
Transaction of the ASAE, Vol 13, No 2, p 221-224, 231, March 1970. 3 fig, 5 tab, 15 ref.

Descriptors: *Farm wastes, *Poultry, *Odor, *Chemicals, Costs.
Identifiers: *Odor panel, *Masking agents, *Counteractants, Deodorants, Digestive deodorants, D-indices.

A matching-standard method was successfully used for the evaluation of the ability of commercial odor-control chemicals to mask or eliminate the offensive odor of poultry manure when added directly to the waste in both loboratory and field tests. The method enables one to find the most effective chemicals in a systematic and relatively time-saving manner. The method provides information on the lowest concentration of chemical necessary to obtain a desired effect. Masking agents and counteractants were found to be the most effective odor-control products, deodorants were moderately effective, and digestive deodorants were least effective. The cost in some field trials was estimated to be 63 cents per 450 gal. of liquid manure. Further research is needed on the effect of repeated applications of odor-control products on soil, so as not to harm the soil for other purposes. (White-Iowa State)
W71-02624

SOME ECONOMIC PLANNING CONSIDERATIONS OF GROUNDWATER POLLUTION FOR THE UPPER PAWCATUCK RIVER BASIN IN RHODE ISLAND,
Rhode Island Univ., Kingston. Dept. of Economic Planning and Regional Development.
Arnold Joseph Antak.
Masters Thesis, 1970. 119 p, 8 fig, 23 tab. OWRR Project A-032-RI (1).

Descriptors: *Water supply, *Groundwater, *Economics, *River basin development, Optimum development plans, Project planning, Long term planning, Water pollution control, Water management (Applied), Water resources development, Water sources, Planning, Rhode Island.
Identifiers: *Pawcatuck River Basin, R.I., *Groundwater pollution.

This thesis is concerned with the economics of supplying potable water to the Upper Pawcatuck River Basin in Rhode Island. The basic question considered was whether or not it is more economical to develop and maintain pollution - free the large groundwater reserves in existence there, or to not protect these groundwaters, and instead, develop a surface water supply. Groundwater development and protection would consist of a large municipal well development and regional sewerage facilities to prevent the private disposal of sewage. Alternative development of a surface water supply would require an impounding reservoir. It was found that no serious groundwater pollution problem presently exists, but that the potential for future problems does exist. Cost data were obtained from various sources and estimates of the developmental costs of regional sewerage facilities, municipal groundwater development, and a surface impounding reservoir were made. It was found that the combination of groundwater development, and regional sewerage was less expensive than the development of a surface water supply for systems of similar capacity. It is recommended that the planning of water supplies and sewerage be done on a comprehensive basis by considering them as a single function. (Hewett-Rutgers)
W71-02628

FACILITY PLANNING FOR A PUBLIC SERVICE SYSTEM: DOMESTIC SOLID WASTE COLLECTION,
University of Southern California, Los Angeles. Dept. of Urban and Regional Planning.
For primary bibliographic entry see Field 06A.
W71-02632

PHOSPHORUS, NITROGEN, AND ALGAE IN LAKE WASHINGTON AFTER DIVERSION OF SEWAGE,
Washington Univ., Seattle. Dept. of Zoology.
For primary bibliographic entry see Field 05C.
W71-02681

PRINCIPLES AND PRACTICES OF BEEF CATTLE FEEDLOTS,
Queensland Univ., Brisbane (Australia). Dept. of Animal Husbandry.
W. J. Pryor.
Australian Veterinary Journal, Vol 46, No 4, April 1970, p 173-177. 2 tab, 1 fig, 17 ref.

Descriptors: *Cattle, *Animal diseases, *Costs, Profit, Nutrient requirements, Silage, Sorghum, Wheat, Performance, Water pollution control.

Identifiers: *Feedlots, Feelot management, Feeding systems, Green chop.

It is believed the emergence of a large feedlot industry will be dependent primarily on two factors, the first being the availability of cheap feed and the availability of store cattle at a price which will permit a margin after they have been lot fattened, and the other, the introduction of a satisfactory national system of carcass grading and identification. A description is given of the principles involved in the management of feedlots with special reference to conditions operating in northern Australia. The importance of concentrate to roughage ratios and protein and mineral requirements are stressed. Diseases have played only a minor part in feedlot management in Australia thus far, and it is suggested that the veterinarian can play a more useful role in supplying sound advice on economic feeding and management. (White-Iowa State)
W71-02691

LOCATING A POULTRY ENTERPRISE,
Illinois Univ., Urbana.
S. F. Ridlen, and Hugh S. Johnson.
Illinois Monthly Poultry Suggestions, July 1970. Poultry Digest, Vol 29, No 344, p 495-496, October 1970.

Descriptors: *Locating, Farm wastes, *Poultry, Eggs, Water pollution control.
Identifiers: *Enterprise, Neighbor problems.

The chief characteristics that should be evaluated in selecting the location of a poultry enterprise are discussed. These include land cost, tax rate, water supply and topography; electricity, labor, feed supply and transportation should be considered; human population, zoning, acceptance of poultry by local people and relationship to market are important. (Christenbury-Iowa State)
W71-02698

ANIMAL WASTE MANAGEMENT.
Cornell Univ., Ithaca, N.Y.
For primary bibliographic entry see Field 05D.
W71-02701

REFLECTIONS ON POLLUTION CONTROL,
Zurn Industries, Inc., Washington, D.C.
Leon W. Weinberger.
In: Animal Waste Management, Proceedings, Cornell University, Conference on Agricultural Waste Management, p 1-3, 1969.

Descriptors: *Farm wastes, *Water pollution, *Water quality, *Cost-benefit ratio, Water pollution control, Environment, Waste water treatment.
Identifiers: *National policy, National misconception.

Dr. Weinberger expresses three personal viewpoints dealing with national policy on water pollution control, cost benefit analysis in water pollution control, and finally comments on the greatest myth or misconception in water pollution control. This national misconception being that we do not know how to solve the problems of water pollution control. Dr. Weinberger asks everyone to speak out and be heard on the way that you want to have our environment. (White-Iowa State)
W71-02702

EFFECTS OF WATER QUALITY STANDARDS ON THE REQUIREMENTS FOR TREATMENT OF ANIMAL WASTES,
Federal Water Pollution Control Administration, Washington, D.C.
Harold Bernard.
In: Animal Waste Management, Proceedings Cornell University Conference on Agricultural Waste Management, 1969, p 9-16. 1 tab, 2 fig, 5 ref.

Descriptors: *Farm wastes, *Legal aspects, *Water quality act, Biochemical oxygen demand, Chemical oxygen demand, *Water quality standards, Municipal wastes, Industrial wastes, Waste water treatment.
Identifiers: FWPCA, Animal feedlot, *Disposal requirements, *Waste treatment standards, Environmental backlash, Interstate waters.

Changes that have taken place in water quality standards are discussed. The purpose of the standards is to: (a) provide an engineering base for the design of waste treatment works by municipalities and industries without uncertainties in waste disposal requirements in interstate waters. (b) Serve as a clear public (local) policy statement on the use or uses to which specific segments of interstate waters may be put after due consideration of all the factors delineated above. The effect of these changes in standards is discussed with relation to the treatment of animal wastes. Future municipal B.O.D. loads and their subsequent treatment costs are brought out. It is mentioned that the FWPCA is interested in receiving proposals to demonstrate new or unique treatment and control techniques for animal wastes, especially in conjunction with an on-going operation. Only with the cooperation and leadership of the industry itself can techniques be developed to meet the various water quality standards and enable the industry a growth unimpeded by any environmental backlash. (White-Iowa State)
W71-02704

THE CHALLENGE OF ANIMAL WASTE MANAGEMENT,
Cornell Univ., Ithaca, N.Y.
Raymond C. Loehr.
In: Animal Waste Management, Proceedings Cornell University Conference on Agricultural Waste Management, 1969, p 17-22. 5 ref.

Descriptors: *Farm wastes, Odors, Waste water treatment.
Identifiers: *Animal production, *Waste management, Environmental quality, Interrelationships of animal production, Study and research.

There is a woeful lack of understanding of the interrelationships between various aspects of animal production and waste management. It is to this point and to these relationships that this paper is addressed. The long term approach for animal production must be based upon not only optimal production of the product, but also on management of the entire production scheme such that it is consistent with the maintenance of acceptable environmental quality not only to the animals, and to the producers, but to society as a whole. The problem of animal waste management is actually many problems. It consists of technical, economic, social, educational, and perhaps above all, a communications problem. The talents of individuals from many disciplines are needed to produce better solutions to the problem. We need to initiate more studies that will take an overview of the animal production operation, feasible waste management systems, and their interrelationships. These studies should develop information that can be used as predictive and/or decision making tools to anticipate and minimize problems that may result. Herein lies the greatest challenge of animal waste management. (White-Iowa State)
W71-02705

DESIGN PARAMETERS FOR THE STABILIZATION OF HIGHLY ORGANIC MANURE SLURRIES BY AERATION,
Rutgers - The State Univ., New Brunswick, N.J. Dept. of Environmental Sciences.
For primary bibliographic entry see Field 05D.
W71-02707

FEEDLOT POLLUTION CONTROL - A PROFILE FOR ACTION,
Federal Water Pollution Control Federation, Kansas City, Mo. Missouri Basin Region.
John M. Rademacher, and Anthony V. Resnik.
In: Animal Waste Management, Proceedings Cornell University Conference on Agricultural Waste Management, 1969, p 193-202. 17 ref.

Descriptors: *Farm wastes, *Water pollution control, *Legislation, Groundwater, Water Quality Act.
Identifiers: *Feedlots, *Animal production, Research, Regulation.

This paper set the stage for the presentation of technical papers which followed at the Cornell University Animal Waste Management Conference. The background of animal production and examples of the pollution problem were given. Factors causing the problem of animal waste disposal were discussed as well as accomplishments to date. These accomplishments included Federal laws to control pollution. A profile for action was presented as a model for action. The essential elements were Re-education, Research and Regulation. He states that we have neither adequate knowledge for control nor full cooperation and involvement of all levels of Government and the private sector to solve the problems resulting from feedlot operations. More attention must be given to feedlot location and research devoted to the institutional problems of animal waste management. There must be an organized and coordinated, interdisciplinary approach to animal waste disposal. (White-Iowa State)
W71-02725

CATTLE FEEDLOT WATER QUALITY HYDROLOGY,
Colorado State Univ., Fort Collins. Dept. of Agricultural Engineering.
T. E. Norton, and R. W. Hansen.
In: Animal Waste Management, Proceedings Cornell University Conference on Agricultural Waste Management, 1969, p 203-216. 2 tab, 14 fig, 14 ref.

Descriptors: *Farm wastes, *Cattle, *Hydrographs, *Water quality, Rainfall simulators, Rainfall intensity, Biochemical oxygen demand, Runoff, Alkalinity, Water pollution control, Waste water treatment.
Identifiers: *Feedlot runoff, *Hydrology characteristics, Surface storage, Effective depth, Overland flow.

The hydrologic and quality characteristics of runoff waste water resulting from precipitation on cattle feedlots are presented. The overall objective of the study was to determine if the hydrology characteristics could be correlated with the quality characteristics through a modification of the flat plate model of overland flow. Once this correlation was established, the results were used to predict the quantity and quality of the runoff from existing feedlots. The field equipment consisted of rainfall simulation equipment and a sample collection and control device. Runoff was collected and analyzed from a 28 sq. ft. plot in 18 separate runs on 13 different feedlots. The pollution characteristics of BOD, dissolved solids and alkalinity were correlated with an effective depth of overland flow. The correlation method and equations developed were used in an example of BOD prediction. (White-Iowa State)
W71-02726

THE EFFECT OF FEED, DESIGN AND MANAGEMENT ON THE CONTROL OF POLLUTION FROM BEEF CATTLE FEEDLOTS,
Texas Technological Coll., Lubbock. Dept. of Agricultural Engineering.
W. Grub, R. C. Albin, D. M. Wells, and R. Z. Wheator.
In: Animal Waste Management, Proceedings Cornell University Conference on Agricultural Waste Management, 1969, p 217-224. 5 fig, 2 tab.

Descriptors: *Farm wastes, *Cattle, *Runoff, Biochemical oxygen demand, Nitrogen, Phosphorus, Water pollution control.

Identifiers: *Feedlots, *Composition of wastes, Rations, Feedlot layout, Waste accumulation.

Incorporating both engineering and biological aspects, this report contains an analysis of data and suggests management and design practices that could materially reduce the pollution contributed from the small but densely populated feedlot area. The composition and quantity of wastes is looked at. The type of ration and changes in accumulated wastes are discussed in relation to the former topics. The effects of precipitation, surfacing material, land slope, depth of waste accumulation, feedlot layout, and ration composition are discussed with respect to composition and quantity of runoff. (White-Iowa State)
W71-02727

LIVESTOCK PRODUCTION VS. ENVIRONMENTAL QUALITY - AN IMPASSE,
Economic Research Service, Washington, D.C. Natural Resource Economics Div.
Joseph P. Biniek.
In: Animal Waste Management, Proceedings Cornell University Conference on Agricultural Waste Management, p 363-368, 1969. 14 ref.

Descriptors: *Farm wastes, *Economic efficiency, Water Quality Act, Air pollution, Odors, Water pollution control.
Identifiers: *Livestock production, *Production efficiency, *Environmental quality, Quality standards, Public conern, Economic development.

The possibilities of merging the two objectives of production efficiency and environmental quality are explored. To establish a basis for merging the two objectives, the author discusses environmental quality, quality standards, and public concern. Secondly he reviews the changing concepts of economic efficiency and illustrates these changes by discussing four stages of economic development. The discussion is concluded with a section devoted to the merging of the two objectives, environmental quality and production efficiency. An impasses can be averted, but it will require new modes of thought, and constructive responses to new situations. (White-Iowa State)
W71-02742

WHO SHOULD REGULATE POULTRY CONFLICT PROBLEMS,
Cornell University, Ithaca, N.Y. Coll. of Agriculture.
For primary bibliographic entry see Field 05D.
W71-02747

06. WATER RESOURCES PLANNING

6A. Techniques of Planning

A MODEL RELATING WATER QUALITY, VEGETATIONAL STRUCTURE AND URBANIZATION IN THE SAN JACINTO RIVER BASIN,
Houston Univ., Tex. Dept. of Biology.
For primary bibliographic entry see Field 05G.
W71-02271

APPLICATION OF THE SSARR MODEL TO A BASIN WITHOUT DISCHARGE RECORD,
Weather Bureau, Salt Lake City, Utah. Western Region.
For primary bibliographic entry see Field 02A.
W71-02297

METROPOLITAN WATER SYSTEM OPERATION SUBSEQUENT TO NUCLEAR ATTACK OR NATURAL DISASTER,
Dallas Water Utilities Dept. Tex.
For primary bibliographic entry see Field 05F.
W71-02299

A DISPERSION MODEL FOR HEATED EFFLUENT FROM AN OCEAN OUTFALL,
Naval Postgraduate School, Monterey, Calif.
For primary bibliographic entry see Field 05B.
W71-02605

EXTERNALITIES, OPTIMALITY AND INFORMATIONALLY DECENTRALIZED RESOURCE ALLOCATION PROCESSES,
Northwestern Univ., Evanston, Ill.
Antonia Camacho.
International Economic Review, Vol 11, No 2, p 318-327, June 1970.

Descriptors: *Resource allocation, *Economic planning, Input-output analysis, Economic environment optimization.
Identifiers: *Externalities, *Pareto-satisfactory, Adjustment process, N components, Cartesian product, Set theory.

This paper is mainly devoted to presenting an informationally decentralized adjustment process with Pareto-optimal equilibria for economies or environments where externalities exist. The economic environment is defined as the set of economic units or participants of the economy, their initial resource endowments, and their production possibilities and preferences. The n components of the environment uniquely determine the economic environment and its Pareto-optimal set. The adjustment process is defined as a set of rules for exchanging information among the economic units regarding their components of the environment in order to reach an agreement about an economic program for implementation. The informationally decentralized adjustment is shown to be external and anonymous. Furthermore, this process is Pareto-satisfactory since it is single valued, nonwasteful or Pareto-optimal and unbiased. This paper is relevant for water studies concerned with the theoretical basis of welfare analysis as it may apply to problems in water resource allocation. (Siegenthaler-Rutgers)
W71-02631

FACILITY PLANNING FOR A PUBLIC SERVICE SYSTEM: DOMESTIC SOLID WASTE COLLECTION,
University of Southern California, Los Angeles. Dept. of Urban and Regional Planning.
George P. Schultz.
Journal of Regional Science, Vol 9, No 2, p 291-307, August 1969.

Descriptors: *Decision making, Cost function, Bay, Solid waste system, Linear programing, Average cost.
Identifiers: *Facility planning, Collection cost, Planning period.

This paper develops a decision model for planning transfer stations used in an indirect haul system for domestic solid waste collection service. The objective is to minimize long run average cost per household subject to the constraint that a given quantity and quality of service be maintained. The model proposed allows for planning a new set of facilities and for the expansion of present facility capacity. The cost functions are estimated as well as the choice of values for the decision variable. The decision model is further subgrouped into submodels dealing separately with size, location and timing. The first submodel establishes facility capacity and service area for a hypothetical city. The second model distributes these facilities over the city and minimizes collection costs. The third submodel defines the optimal capacity increment and time interval for one facility serving an area having a linear population growth function. The techniques of this study may prove applicable to water waste disposal problems. (Siegenthaler-Rutgers)
W71-02632

A RECURSIVE PROGRAMING FOR NONSTRUCTURAL FLOOD DAMAGE CONTROL,
Arizona Univ., Tucson.
John C. Day.
Water Resource Research, Vol 6, No 5, p 1262-1271, October 1970.

Descriptors: *Land use management, *Economic efficiency, Economic rent, Constraint, Benefit-cost analysis.
Identifiers: *Floodplain land use, *Recursive programing, Objective function, Payoff, Present value.

Flood control projects such as levees, channel improvements, and reservoirs are no longer adequate methods for the prevention of flood damage and losses. This paper considers a floodplain land use management or nonstructural approach to urban land damage control. The model discussed enables nonstructural alternatives such as spatial planning, site elevation and flood proofing to be evaluated on a common basis with structural measures. The model developed uses recursive linear programing for allocating specific land uses to specific parts of the floodplain. Alternative land uses which employ various levels of land fill and flood proofing are evaluated according to the economic value a community gains from its lands. As a planning tool, given aggregate land use requirements, the model evaluates nonstructural alternatives in terms of their economic feasibility and effects on economic rents. Optimal land use activities are then selected for various planning periods. This model is relevant for water resource planners involved with floodplain management. (Siegenthaler-Rutgers)
W71-02646

PROVISIONAL 1967 COLORADO INPUT-OUTPUT STUDY,
Colorado State Univ., Fort Collins. Dept. of Economics.
For primary bibliographic entry see Field 06B.
W71-02649

6B. Evaluation Process

POTOMAC-SHENANDOAH RIVER BASIN COMPREHENSIVE WATER RESOURCES PLAN: VOLUME 5-ENGINEERING DEVELOPMENT ALTERNATIVES.
Virginia Dept. of Conservation and Economic Development, Richmond. Div. of Water Resources.

Virginia Division of Water Resources Planning Bulletin 221, August 1970. 452 p, 109 plate, 108 tab, 1 append.

Descriptors: *Water resources, *Management, *Planning, Reservoirs, Statistical methods, Watershed management, Flood control, Waste treatment, Recreation facilities, Erosion control, Sediment control, Water demand, Cost analysis, *Virginia.
Identifiers: Potomac-Shenandoah River basin (Va).

This is the fifth in a series of six volumes which contains a plan for development of the water resources of the Potomac-Shenandoah River basin in Virginia. Various elements of water resources development and management which may fulfill the basin needs now and in the future are examined. Costs which will be associated with various water quality standards in the basin are analyzed. Areas where conflicting demands on the water resource may occur are pointed out. There are varying degrees of detail for different areas in the basin due to the wide variety both of technical data and in the urgency of required solutions. Reservoir mass curves, tables, and maps are included. (Woodard-USGS)
W71-02216

METROPOLITAN PLANNING GUIDELINES, SEWAGE TREATMENT (FACILITIES).
Northeastern Illinois Planning Commission, Chicago, Illinois.
For primary bibliographic entry see Field 05D.
W71-02284

A COMPARATIVE ANALYSIS OF AMERICAN AND CANADIAN GOVERNMENTAL ARRANGEMENTS FOR THE DEVELOPMENT OF REGIONAL WATER POLICY IN THE COLUMBIA RIVER BASIN,
Washington Univ., Seattle. Dept. of Political Science.
For primary bibliographic entry see Field 06E.
W71-02499

A COMPREHENSIVE APPROACH FOR INDIA'S WATER RESOURCES DEVELOPMENT,
Nevada Univ., Reno. Desert Research Inst.
Dinesh C. Sharma.
Annals of Arid Zone, Vol 9, No 1, p 1-9, March 1970. 4 fig, 6 ref.

Descriptors: *Water resources development, *Groundwater, *Regional analysis, *Administration, *Planning, Water supply, Water conservation, Systems analysis, Groundwater basins, Hydrologic budget, Surface waters, Economic efficiency, Estimated benefits, Estimated costs, Programs, Agriculture, Data collections, Irrigation practices, Hydrogeology, Analytical techniques, Water utilization.
Identifiers: *India.

Agricultural activities in India produce one-half the national income and employ three-fourths of the working class. A fundamental fact of life in India is the low per acre yield because of poor soil management practices and ignorance of modern techniques. Due to low, unpredictable rainfall, a large part of the country is designated marginal for agriculture. High efficiencies in conservation and use of water are crucial in these areas. Surface water supplies have been heavily utilized and the only possible improvements will involve more careful management for optimal utilization. For a number of reasons, groundwater supplies have been largely unutilized, although they offer the only other important water source during monsoon failure. The advantages and disadvantages of groundwater are discussed and it is felt that India may conveniently be divided into 5 regions for the purpose of undertaking a national regional groundwater survey with the purpose of locating and developing reliable groundwater supplies. A 5-phase program is outlined, organized around groundwater-flow systems analyses and efficient administrative organization. Tentative organizational flow charts are presented. (Casey-Arizona)
W71-02511

HOW GREEN IS THE GREEN REVOLUTION,
William C. Paddock.
BioScience, Vol 20, No 16, p 897-902, 15 August 1970. 15 ref.

Descriptors: *Water costs, *Irrigation programs, *Economic efficiency, *Economic impact, *Grains (Crops), Financing, Weather, Cost-benefit analysis, Cost transfer, Economic feasibility, Economic prediction, Arid lands, Tropical regions, Water allocation (Policy), Water resources, Water utilization, Water values, Water yield, Crop production, Political aspects, Population, Social impact, Social values, Wheat, Rice, Rainfall, Mexico, Agriculture.
Identifiers: *High-yield varieties, *Over population problems, *Green Revolution, *Under-developed countries, *Agricultural subsidies, Phillipines, India, Asia.

The author argues that the existence of a Green Revolution in the underdeveloped world is largely an illusion. The years of greatest success of the so-called Green Revolution (1967-1969) coincided with a period of unusually high rainfall in Asia and increases in production would have occurred with or without new technology. Only 2 high-yield crops have actually been developed: wheat and rice. Social factors in Asian countries militate against wheat, and rice yields have stagnated after early increases. Further, excessive concentration upon a limited number of varieties is decreasing the available gene pools of these crops, with unquestionable future adverse affects. Where yield increase success has occurred, it has been facilitated by increased inputs of high-cost irrigation water and fertilizers. These uneconomic applications to relatively low value crops have resulted from government subsidies to these sectors, removing them from marketplace discipline. They are essentially internal transfer payments adding to national debt load and constitute little or no overall increase in national production. It is felt that for political reasons, 2 critical problems will result from the Green Revolution illusion: (1) lessened government concentration in the agricultural sector and (2) avoidance of facing the most crucial problem of all -- overpopulation. (Casey-Arizona)
W71-02513

MERCER COUNTY, NEW JERSEY, COMPREHENSIVE PLAN: STORM WATER RUNOFF AND DRAINAGE FACILITIES.
Mercer County Planning Board, Trenton, N.J.
For primary bibliographic entry see Field 04A.
W71-02602

A STUDY OF ECONOMIC VALUE OF INCREASED ESSA SERVICES AS RELATED TO ESTUARINE DYNAMICS IN GULF COAST ESTUARIES, VOLUME I,
Gulf Universities Research Corp., Galveston, Tex.
For primary bibliographic entry see Field 02L.
W71-02606

A STUDY OF ECONOMIC VALUE OF INCREASED ESSA SERVICES AS RELATED TO ESTUARINE DYNAMICS IN GULF COAST ESTUARIES, VOLUME II, APPENDICES,
Gulf Universities Research Corp., Galveston, Tex.
For primary bibliographic entry see Field 02L.
W71-02607

REGIONAL WATER AND SEWERAGE FACILITIES PLAN 1990.
Indian Nations Council of Governments, Tulsa, Okla.
For primary bibliographic entry see Field 05D.
W71-02611

SOME ECONOMIC PLANNING CONSIDERATIONS OF GROUNDWATER POLLUTION FOR THE UPPER PAWCATUCK RIVER BASIN IN RHODE ISLAND,
Rhode Island Univ., Kingston. Dept. of Economic Planning and Regional Development.
For primary bibliographic entry see Field 05G.
W71-02628

ADVANCE PLANNING SUCCESS IN CHICAGO,
Chicago Dept. of Water and Sewers, Ill.
James W. Jardine, and Louis R. Howson.
Journal American Water Works Association, Vol 62, No 7, p 397-399, July 1970. 1 tab.

Descriptors: *Long term planning, *Future planning (Projected), *Estimated costs, Construction costs, Project planning, Estimating, Forecasting, Utilities, Water resources development, Cities, Water resources, Planning, Illinois.
Identifiers: *Chicago Water Works, Chicago.

Advance planning is important in determining a construction schedule which will expand and maintain water resources facilities to meet increasing demands at the lowest possible cost. The City of Chicago has predicted the expenditure of $370 million (1969 price level) for new construction over the thirty year period 1969 - 2000. The magnitude of this figure justifies the careful survey of past, present, and future water requirements. Future water requirements, will reflect the growth of population in Chicago and a slight increase in per capita consumption. Long range planning must then be based on these factors and must also include a determination of areas in which water requirements will increase most. Very great savings have been accomplished through waste control in the system, and on the premises of the consumers. Waste control has decreased the amount of water lost to such an extent that the pumping requirements to the system have not increased significantly in spite of substantial ppulation growth. The average yearly expenditure for renewal and replacement of equipment over the next 30 years is estimated at $7.7 million, or 1.5% of the total investment in the Chicago Water Works. Currently the average family pays $37.50 per year for water, while metered customers pay $.275 per thousand gallons. (Hewett-Rutgers)
W71-02630

PRIVATE GOOD, EXTERNALITY, PUBLIC GOOD,
Glasgow Univ. (Scotland).
Alan W. Evans.
Scottish Journal of Political Economy, Vol XVII, No 1, p 79-89, February 1970.

Descriptors: *Welfare economics, Marginal utility demand curve, Flood control.
Identifiers: *Public good, *Externality, Pareto optimality, Social welfare function, Semi-public good, Private good, Consumption externality.

The purpose of this paper is to demonstrate that the welfare conditions for a public good are a special case of the welfare conditions for a consumption externality. A public good is defined (according to Samuelson in 1958) as a good which all enjoy in common so that each individual's consumption of such a good leads to no subtraction from any one else's consumption of that good. The welfare conditions for goods with external effects are derived. The optimality conditions for an ordinary externality are identical with the optimality conditions for a public good only when the good is consumed by only one person in the economy, the other consumers bearing the external effects. Since there is a distinction between public goods and goods with consumption externality, the terminology should be preserved for ease of classification. This article provides a general theoretical background for water studies concerned with the public-good aspects of water resource development. (Seigenthaler-Rutgers)
W71-02633

BENEFIT-COST ANALYSIS AND DEMAND CURVES FOR PUBLIC GOODS,
Princeton Univ., N.J.
David F. Bradford.
Kyklos, Vol XXIII, Fasc 4, p 775-790, 1970.

Descriptors: *Demand, *Optimization, *Social aspects, Economic evaluation, Economic efficiency, Cost-benefit analysis, Decision-making, Spillovers, Marginal cost, Production, Government, Welfare economics.
Identifiers: *Public goods, *Aggregate bid curve, Pareto optimality, Externalities, Individual preferences.

This study is concerned with the problem of ascertaining the demand curve for public water resource investments. The author suggests the use of total quantities rather than averages in the analysis of public goods. He discusses the use of a demand curve construction, which he calls an aggregate bid curve. This is a device which builds upon the intuitive notion of bargaining to reach a collective decision. It has the advantage of making the potential gains from trade evident in movements towards a Pareto optimal level of public goods provision. It also clearly distinguishes the concept of a benefit in benefit-cost analysis. The author demonstrates that all of the conditions of efficiency, even in the presence of public goods and externalities can be derived with this formulation of the demand function. (Murphy-Rutgers)
W71-02636

DILEMMAS OF ECONOMIC BEHAVIOR VIS-A-VIS ENVIRONMENTAL POLLUTION,
Vienna Univ. (Austria).
Robert Reichardt.
Kyklos, Vol XXIII, No 4, p 849-865, 1970.

Descriptors: *Environmental pollution, Cutical path method, Cost, Risk.
Identifiers: *Public consumption good, Ecosystem, Time-preference, Income redistribution, Game theory, Payoff.

This article considers the reasons for the delays in improving the human environment. The author discussed the following topics: the measurement of environmental quality, its symbolic appeal, the structure of possible actions and conflicting economic motivations with respect to the environment. The measurement of environmental quality, a public consumption good, is difficult because of differences in perception, adaptation, and time preference. The Critical Path Method, a management technique, is applied to an example of a lake threatened by water pollution in order to demonstrate the necessary actions to solve the problem. Conflicting economic motivations toward environmental pollution are analyzed through economic roles or vested interests and attitudes toward environmental change. Among the roles discussed are that of the polluting consumer, the polluting producer, the anti-pollution device producer, and the government. There are conflicts between and within the roles as well as time preference differences. There is a bargaining process where each role-holder tries to maximize his own utility with respect to antipollution legislation and imposes social costs on other agents. Game theory and public expenditure theory are used in the analysis of conflict. A necessary condition for cooperative action is that some agents be involved in altruistic behavior. (Siegenthaler-Rutgers)
W71-02637

THE GENERAL RELATION OF TECHNOLOGIC CHANGE TO EFFICIENCY IN WATER DEVELOPMENT AND WATER MANAGEMENT,
Carnegie Institution of Washington, D.C.
Edward A. Ackerman.
In: Readings in Resource Management and Conservation, Chicago, University of Chicago Press, p 450-467, 1965.

Descriptors: *Technology, *Water resource development, *Water supply, Management, Water demand, Economic feasibility, Planning, Multiple-purpose projects, Operations-research, Meteorology, Economic evaluation, Water quality, Chemical wastes, Aquifers, Conservations, Evaporation, Desalination.
Identifiers: Nuclear explosives.

This report examines the means which may be made available for increasing the efficiency of water supply use for whatever specific objectives which may be chosen by Congress. The author presents those aspects of new technology related to future water resource development. The different alternatives are evaluated in terms of their applicability to specific purposes and regions, the economic feasibility in relation to the water supply and water savings, and the present state of development. The techniques discussed are those relating to the planning, design, construction and operation of systems of multiple-purpose works; the exploration for, discovery and exploitation of new supplies; the measures for conservation and reduction of demand, and the treatment and use of waters having substandard quality. (Murphy-Rutgers)
W71-02638

REGIONAL PLANNING AND FLOOD PLAIN MANAGEMENT,
Pennsylvania State Planning Board, Harrisburg.
Irving Hand.
In: Proceedings of the Fourth American Water Resources Conference, New York, p 241-254, November 18-22, 1968.

Descriptors: *Flood plains, *Management, *Flood control, Non-structural alternatives, Flood plain zoning, Flood damage, Costs, Regional analysis, Planning, Government, Land use, Government.
Identifiers: *Flood plain management, *Pennsylvania Act 442, Subdivision, Building codes.

The author examines the developments relating to the need for concern with flood plain management and the various agencies which have been involved in dealing with these issues. The continuing presence of large flood damage costs emphasizes the need for controling development in flood plain areas. This should be the function of the regional planning agency. The author considers such possible non-structural measures available to implement plans for flood plain management as zoning, subdivision regulation, building and construction codes and the reservation of certain areas for future public acquisition. These are evaluated in terms of their feasibility and effectiveness. (Murphy-Rutgers)
W71-02640

REGULATION AND THE FREE MARKET: THE PROBLEM OF BOUNDARIES,
Vanderbilt Univ., Nashville, Tenn. Dept. of Economics.
James W. McKie.
The Bell Journal of Economics and Management Science Vol 1, No 1, p 6-26, Spring 1970.

Descriptors: *Public utilities, *Prices, *Costs, *Welfare economics, Optimization, Rate of return, Marginal cost, Competition, Resource allocation, Economic evaluation, Regulation, Government, Value, Economic efficiency, Spillover, Capital cost, Management.
Identifiers: Electric utilities, Rate discrimination, Value of Service, Boundaries.

This paper deals with the problem of utility pricing and external limits to the regulated activities of public utilities in a competitive environment. The problem of correct pricing procedures and limits on the growth of water utilities may be clarified by this article. The author shows that as long as a utility is relatively isolated and self-contained its pricing problems are relatively simple and the system is satisfactory from the point of view of economic welfare as long as it fulfills the marginal conditions. However, a boundary problem appears whenever regulated activities are intermingled with non-regulated ones or when public utilities compete with each other or with unregulated industries, or where technological innovation and new forms of organization lead to new kinds of activities for the public utility. The paper demonstrates that this may distort the attainable degrees of discrimination, customer classifications, the internal structure of profit margins, the stability of prices, and the rate of return and lead to the condition of pricing below marginal cost. (Murphy-Rutgers)
W71-02642

RECREATION DEMAND FUNCTIONS AND THE IDENTIFICATION PROBLEM,
Cornell Univ., Ithaca, N.Y. Dept. of Agricultural Economics.
Robert J. Kalter, and Lois E. Gosse.
Journal of Leisure Research, Vol 2, No 1, p 43-53, Winter 1970.

Descriptors: *Recreation demand, *Decision making, Time series analysis, Cross section, Forecasting, Resource allocation, Economic efficiency, Cost-benefit analysis, Elasticity of demand.
Identifiers: **Identification problem, *Structural demand, Reduced form equation, User response model, Econometrics, Equity, Consumer surplus.

This paper considers the identification problem of demand equations in the study of outdoor recreation. Improper accounting of demand and supply can lead to projections of supply imbalances. One approach to this problem is to use reduced form equations and user response models. These models assume that the effect on use of a given increase in facilities is constant regardless of the magnitude or location of such an increase. These models do not yield a true recreation demand estimate and result in another identification problem. The identification problem has been linked to the use of time series data and reliance on site-oriented recreation demand studies. The authors stress the importance of the structural demand equation approach for obtaining estimates of the economic value of recreation for use in public decision-making. A solution to the identification problem is presented with the suggestion that individual cross section data be used to estimate a traditional market type of recreation demand equation rather than a site-specific function. The cost of the entire recreational experience should be used as the price variable. The authors claim that the special nature of costs associated with participation in outdoor recreational activities and the spatial distribution of recreation facilities make this model feasible. This article is relevant to studies concerned with estimation water-oriented recreation demand. (Siegenthaler-Rutgers)
W71-02643

ECONOMIC OPTIMIZATION AND RESERVOIR RECREATION,
Kentucky Univ., Lexington. Dept. of Civil Engineering.
L. Douglas James.
Journal of Leisure Research, Vol 2, No 1, p 16-29, Winter 1970.

Descriptors: *Recreation reservoir, *Marginal benefit, Marginal cost, Gravity model, Cost-benefit analysis.
Identifiers: *Economic optimization, Psychological capacity.

In determining optimum project size, planners choose the size that maximizes benefits net of costs. With respect to a reservoir recreation facility, it is difficult to apply marginal economic analysis because of the difficulty in estimating visitation to a larger facility. In the past, planners used previous experience to determine the size of the proposed reservoir or a total benefit approach. However, to have an optimum size, marginal benefits must be calculated before they can be compared to marginal cost. The procedure presented provides a means for estimating visitation as a function of provided visitor capacity required to derive the marginal benefit curve. Visitation data are collected from existing reservoirs in a similar environment to find reservoir capacity for visitors and to estimate the effect of capacity on annual visitations. The author advises planners to evaluate the necessary empirical coefficients from locally applicable data. (Siegenthaler-Rutgers)
W71-02648

PROVISIONAL 1967 COLORADO INPUT-OUTPUT STUDY,
Colorado State Univ., Fort Collins. Dept. of Economics.
Clyde R. Smith.
M.S. Thesis, August 1970. 41 p, 8 tab, 1 fig, 41 ref.

Descriptors: *Input-output analysis, *Resource allocation, Mathematical model, Industrial production.
Identifiers: *Interindustry approach, *Transactions matrix, Output multiplier, Payment sector, Direct coefficient, Indirect coefficient, Exogenous.

This thesis examines the economic interrelationships of Colorado's economy using input-output analysis. This study builds a provisional input-output model of Colorado for the year 1967 which describes the intra- and-intersectoral flow of goods and services in Colorado's economy. For the analysis, the economy of Colorado was divided into fifteen processing or producing sectors and one exogenous sector. Sectors were chosen on the basis of available secondary data and the importance of water to the sector. An aggregated 1963 United States transactions table for these sectors was

developed. Given this table, the United States direct coefficients were determined as well as the indirect coefficients and output multipliers. It was assumed that Colorado's technical or direct coefficients correspond identically to those of the United States. Given this assumption, it was possible to derive a transactions table for Colorado. However, because of the lack of primary data available for Colorado, the author concluded that the transaction table was not entirely reliable but magnitude references of an ordinal nature are possible. The author believes this study will prove useful in the determination of a more refined input-output analysis for Colorado. (Siegenthaler-Rutgers)
W71-02649

A SUMMARY ANALYSIS OF NINETEEN TESTS OF PROPOSED EVALUATION PROCEDURES ON SELECTED WATER AND LAND RESOURCE PROJECTS.
Water Resources Council, Washington, D.C.

Report to the Water Resources Council by the Special Task Force, July 1970. 226 p, 7 tab, 4 chart.

Descriptors: *Water resources development, Water management, Planning.
Identifiers: *Water resources planning, Comprehensive planning.

The Report to the Water Resources Council by the Special Task Force includes a summary analysis of 19 tests of proposed evaluation procedures on selected water and land resource projects. The tests pointed up many areas in the report of June 1969, where ambiguities existed and further clarification was required. Further, the test results substantiated that the June report was concerned primarily with concepts and included only a few standards and procedures to implement them. Much of the testing effort was directed toward the development of standards and procedures to implement the concepts. In several tests, the teams explored alternative concepts departing from those presented in the June report. The tests have indicated that multiobjective planning is practical. Emphasis is placed on (1) measurement of plan impacts in terms of benefits and costs; and (2) formulation of alternative plans emphasizing the several national objectives. (Wray-Chicago)
W71-02664

STANDARDS FOR PLANNING WATER AND LAND RESOURCES.
Water Resources Council, Washington, D.C.

A Report to the Water Resources Council by the Special Task Force, Washington, D.C., July 1970. 299 p, 1 fig, 8 tab, 2 charts, 3 maps, 1 append.

Descriptors: *Water resources, *Land Resources, *Planning, *Standards, Methodology, Benefits, Costs, Evaluation, Formulation, Coordination, Cost allocation, Cost sharing.
Identifiers: *Water resources planning, Objectives, System of accounts.

These standards for water and land resource planning are a portion of a Water Resources Council study which proposes a set of principles, standards, and procedures for water and land resource planning. The principles provide the broad policy framework for planning activities and include the conceptual or theoretical basis for planning. The standards provide uniformity and consistency by comparing, measuring and judging benefits, costs, and alternatives. The procedures provide the methods for carrying out the various levels of planning activities, including the selection of objectives, measurement of benefits and costs, and comparison of alternate courses of action. The following topics are considered in the Standards: objectives; benefits and costs; general evaluation standards; plan formulation; a system of accounts; cost allocation, reimbursement, and cost sharing; a national program for Federal and Federally assisted activities; and the coordination and review of planning studies. (See also W71-02666) (Davis-Chicago)
W71-02665

PRINCIPLES FOR PLANNING WATER AND LAND RESOURCES.
Water Resources Council, Washington, D.C.

Report to the Water Resources Council by the Special Task Force, July 1970. 25 p.

Descriptors: *Water resources development, Water policy, *Planning, Decision-making.
Identifiers: *Water resources planning, Comprehensive planning.

The principles for planning water and land resources, together with Standards and Procedures, provide the basis for Federal participation with states and others in Federal and Federally assisted water and land resource projects. Multiobjective planning is stressed to improve the public decision-making process. The four main planning objectives are: (a) national economic development, (b) enhancement of quality of environment, (c) social well-being, (d) regional development. Benefits and costs are considered as they affect the objectives; benefits are positive contributions toward accomplishment and costs are negative. General Evaluation Principles include measurement of benefits and costs, price relationships, consideration of alternatives, scheduling, risk and uncertainty, and updating plans. Planning for water and land resources should be carefully related to other regional planning. Alternative plans of tradeoffs among significant conflicting objectives. A plan will be selected only if the total benefits (monetary and nonmonetary) to all objectives are equal to or exceed the total costs to all objectives. A system of accounts will be established that displays benefits and costs of each plan to the multiobjectives. Reimbursement and cost-sharing policies shall be directed to the end that identifiable beneficiaries bear an equitable share of costs commensurate with benefits received. (See also W71-02665) (Wray-Chicago)
W71-02666

THE SALT RIVER PROJECT OF ARIZONA: ITS ORGANIZATION AND INTEGRATION WITH THE COMMUNITY,
Arizona Univ., Tuscon.
Courtland L. Smith.
Master's Thesis University of Arizona, 1968. 298 p, 12 fig, 18 tab. OWRR B-003-ARIZ (2).

Descriptors: *Urbanization, *Electric power, *Water users, *Decision making, *Social aspects, *Economics, *Legal aspects, Technology, Arizona.
Identifiers: *Salt River Project, National Irrigation Act of 1902.

The Salt River Project is studied in terms of its adaption to rapid urbanization. Discussed here are laws and conventions embodied in the reclamation principle, which provides for the allocation of power revenues to reduce the cost of water to land owners. Charges to water users have decreased in the past thirty years with increased numbers of electric customers, increased electric customer usage and improved efficiency of the power system. Changes which have occurred in the transfer of water from farm to urban uses are enumerated. The project, it is indicated, has tended to accept the requirements of water users while adjusting its technical, economic, legal and social ability in order to continue the distribution of an adequate supply of low cost water. With population increases since World War II, the project has developed programs to educate the public about its activities and objectives; but it is still faced with the decision as to what role the urban public is to take in the decision making practice. A linked set of hypotheses has been developed to explain the project's adaption to urbanization. From this set, the effect of different degrees of disorganization, secularization and individualization can be assessed in relation to the change in the distribution of water with respect to position and the change in position in a social organization with increased numbers of participants. Methods for this study derive from the suggestions of Redfield in The Little Community and the systems concept. Social system components, elements external to the system, and data necessary to describe a social system are discussed. (Preckwinkle-Chicago)
W71-02667

ECONOMICS AND ENVIRONMENTAL IMPACTS OF INCREASING LEISURE ACTIVITIES,
Resources for the Future, Inc., Washington, D.C.
Marion Clawson.
In: Future Environments of North Amaerica, ed. Darling, F. Fraser and Milton, John P., The Natural History Press: Garden City, New York, 1966, p 246. 2 fig, 1 tab, 3 ref.

Descriptors: *Recreation, *Time, *Income, Planning, Urbanization, Seasonal, Environment.
Identifiers: *Leisure, *Anticipation, *Travel, *Recollection, *Psychic environment, Space.

The author contends that the real wealth of a nation is the time of its members: very few studies have been made of it. Leisure, defined here as discretionary time above that needed for the basic subsistence requirements of man, is distinguished from mere idleness in which an individual does not know or is unable to do anything he wishes. Further distinction is seen between leisure and recreation; while leisure is basically a time oriented concept, recreation is a personal experience concept or activity. Similarities are observed between leisure and discretionary income; total amount of leisure, timing and size of its pieces, and its uses are noted as depending largely upon the phase of the individual life cycle. Included is a national time budget and time-division of leisure for 1900, 1950, and projected for 2000. Four major kinds of leisure are evident: Daily, Weekend, Annual, and retirement. With increases in leisure time expected, it is important to consider how each kind will be allotted. Discussion of outdoor recreation as a use of leisure involves a threefold, classification: user-oriented areas, close to where people live, intermediate use areas, designed primarily for day long recreation, and resource based areas more suited to vacation time. Five distinct phases of the recreation experience are outlined and discussed: anticipation, travel to the site, on-site experiences, travel back, and recollection. Discussed also are aspects such as seasonality, space-peaking, impacts on natural environment, and impact on the psychic environment e.g., privacy or solitude. Possible consequences of more leisure are discussed: greater emphasis on consumption and availability of time, and a greater urban dominated society with more urban leisure are considered. (Preckwinkle-Chicago)
W71-02670

TECHNOLOGY, RESOURCES AND URBANISM--THE LONG VIEW,
Michigan Univ., Ann Arbor. School of Natural Resources.
Richard L. Meier.
In: Future Environments of North America, ed Darling, Fraser F. and Milton, John P., The Natural History Press, Garden City, New York, 1966, p 277-288. 16 ref.

Descriptors: *Resource development, *Communication, *Information retrieval, *Technology, *Research facilities, Population, Conservation.
Identifiers: *North America, South Asia, Houseboats.

The author asserts that a new set of insights will reconstruct the outlook for natural resources from nature-centered adaptive policies to urban interests. According to this new view, technology is a means for applying communicable knowledge to the environment (physical, biological, social) so as to produce valuable goods and services. As

knowledge continues to accumulate, the control over unwanted changes in the natural environment will increase. In the United States, it is indicated, no resource scarcity is critical enough to threaten development of the economy during the twentieth century. And by implication, no habitat is in danger due to crises of scarcity. Communicable knowledge enables forecasting to utilize expanding scientific studies and potentiality for substitutes for critical commodities. Materials and energy resources are reviewed for the various regions of North America. And attention is devoted to problems of water and land scarcity. One suggestion is that houseboats may reduce population density; optimism is also given for meteorological advances. Demands for living space while not critical in North America are in South Asia and the author indicates that this could seriously effect North American urbanization. It is contended that cities provide the best locus for human resources development. Cities that develop and grow, generating wealth and attracting the energetic individuals, are built and organized so that human capital is conserved and expanded. It is in the cities that one finds the best storage of information. Research, by piling up evidence and translating it into technological practices, has proven to be the most effective means for obtaining returns from resources. (Preckwinkle-Chicago)
W71-02671

6C. Cost Allocation, Cost Sharing, Pricing/Repayment

RYAN V COMM'RS OF WATER DIST NO 1 (NOTICE REQUIRED FOR VALID ASSESSMENT BY WATER DISTRICT).
For primary bibliographic entry see Field 06E.
W71-02361

BUDGETARY CAPITAL COST ESTIMATES OF 1- TO 10-MGD MULTISTAGE FLASH DISTILLATION PLANTS FOR DESALTING SEAWATER,
Oak Ridge National Lab., Tenn.
For primary bibliographic entry see Field 03A.
W71-02609

RATE MAKING POLICIES AND PRACTICES OF PUBLICLY OWNED WATER UTILITIES,
Florida Univ., Gainesville. Dept. of Economics.
Norman G. Keig, Charles W. Fristoe, and Frederick O. Goddard.
Journal American Water Works Association, Vol 62, No 7, p 425-430, July 1970. 11 tab.

Descriptors: *Water rates, Public utilities, Water costs, Pricing, Cost analysis, Cost allocation, Cost sharing, Costs, Depreciation, Utilities.
Identifiers: *Rate making, Rate schedules, Cost classification.

This article describes various rate making policies and practices of selected publicly owned water utilities, and discusses the degree to which accepted rate making policies are followed. Two widely used bases for determining revenues which are discussed are the 'utility' basis and the 'cash' basis. Various practices which are examined are: the depreciation of facilities, the use of current funds for minor improvements, the use of reserve funds for major improvements, payment of local taxes, contribution to general municipal funds, free public water service, and free fire protection service. The classification of costs on either a demand basis or a functional cost basis, and the classification of customers into special groups are discussed. Four bases for rate schedules are presented and preferences for each type are discussed in relation to the questionnaire data. It was concluded that utilities practice and advocate the collection of sufficient revenue to be self-supporting. Most utilities pay for minor improvements from current funds and depreciate their facilities. A majority of the utilities use the cash method for determining revenues, but a significant number favor the utility method. The creation of reserve funds for major improvements is not often practiced, but is widely advocated. The functional method for classifying costs is more widely practiced than advocated. (Hewett-Rutgers)
W71-02629

THE WELFARE EFFECTS OF ZERO PRICING ON PUBLIC GOODS,
Rutgers - The State Univ., New Brunswick, N.J. Dept. of Economics.
Joseph J. Seneca.
Public Choice, Vol VIII, No 2, p 101-110, Spring 1970.

Descriptors: *Social welfare, Marginal cost, Elasticity, Costs.
Identifiers: *Public good, *Zero pricing, Capacity constraint, Excess demand, Consumer surplus.

Certain public goods such as outdoor recreation have a zero user price because of equity considerations and pricing difficulties. Moreover, these goods are characterized by capacity constraints with the result of excess demand which leads to the rationing of available output. This paper considers the social welfare implications of the capacity constraints and non-price rationing of the public goods. It is shown that if a good is actually priced at long run marginal cost or zero, and there is excess demand, the welfare measures of the discriminating monopolist approach or short run marginal cost pricing overstate the true welfare measure at capacity. If short run marginal cost rises before capacity is reached with zero prices, then situations can exist where welfare can be increased by allowing full capacity utilization even though a quantity restriction based on a shadow short run marginal cost pricing policy would indicate otherwise. This discussion is relevant for water resource planners concerned with congestion and pricing problems. (Siegenthaler-Rutgers)
W71-02635

A MATHEMATICAL FORMULATION OF THE PEAK-LOAD PRICING PROBLEM,
Polytechnic Inst. of Brooklyn, N.Y.
Israel Pressman.
Bell Journal of Economics and Management Science, Vol 1, No 2, p 304-326, Autumn 1970.

Descriptors: *Optimization, Net benefits, Discriminatory pricing, Elasticity of demand.
Identifiers: *Peak-load pricing, Consumer surplus, Producer surplus, Dependent demand, Line integration, Capacity constraint, Profit constraint, Lagrangian multiplier, Marginal capacity cost, Marginal operating cost.

This paper develops mathematical models useful in analyzing the public utility peak-load pricing problem. The objective of the firm is to maximize social satisfaction from services provided. Mathematically, the firm's objective is expressed by maximizing the net benefit (i.e., the consumer surplus plus the producer surplus). The consumer surplus concept is extended to multidimensions to allow for periods where demand functions are both independent and dependent by using the line integral calculus. Demand is said to be dependent when price depends on the quantities of more than one service. The actual objective in the models is to maximize net benefit in a multi-period framework where demands are different for every period and subject to profit and capacity constraints. Peak-load pricing models with profit constraint show that prices depend on marginal operating costs but not on marginal capacity costs. With active profit constraints, price is dependent on the demand elasticities for independent demand but for dependent demand the cross elasticity is relevant also. For capacity constraint models, prices are charged according to marginal cost pricing principles. For both profit and capacity constraint models, prices depend on the marginal cost and demand elasticity. The article is important for water studies concerned with the theoretical foundations of pricing policies. (Siegenthaler-Rutgers)
W71-02641

A NOTE ON COST-BENEFIT ANALYSIS OF INVESTMENTS IN INTERMEDIATE PRODUCTS,
Stockholm Univ. (Sweden).
Leif Magnusson.
Swedish Journal of Economics, Vol 72, No 3, p 215-218, September 1970.

Descriptors: *Cost-benefit analysis, Marginal cost, Economic efficiency, Investment, Equilibrium.
Identifiers: *Intermediate product, Consumer surplus, Producer surplus, Capital good.

The author considers the application of cost-benefit analysis to investments in intermediate products. Intermediate products are capital goods which are used in the production of goods for final consumption. The consumers' willingness to pay for the consumer product can be measured by the area under the compensated demand curve for the capital product in question. However, if price variations occur in consumer product markets, corrections of the investment criterion must be made on the basis of an estimate of the resulting consumers' and producers' gains and losses on the consumer good market. An example of an investment in an irrigation project is given with the maximum willingness to pay for the project measured by the value of the increased supply of irrigation water at ex-post price and consumers' and producers' surplus on the consumer good market under the conditions that all prices are relatively constant and equal to marginal cost. More generally, it is found that an estimate from the market for the intermediate product will, under the above conditions, lead to a correct estimate of the willingness to pay. This article is of interest to water resource planners concerned with the evaluation of prospective projects. (Siegenthaler-Rutgers)
W71-02645

SOME PROBLEMS OF PRICING UNDER STOCHASTIC SUPPLY CONDITIONS: THE CASE OF SEASONAL PRICING FOR WATER SUPPLY,
London Graduate School of Business Studies, London (England).
M. A. Crew, and G. Roberts.
Water Resources Research, Vol 6, No 5, p 1272-1276, October 1970.

Descriptors: *Stochastic processes, *Water supply, Risk, Probability, Constraint.
Identifiers: *Seasonal pricing, Consumer surplus, Social welfare function, Opportunity cost, Lagrangian analysis.

This paper considers some of the problems of seasonal pricing of the water supply with particular attention to the determination of optimal seasonal carryover in a fixed capacity system and optimal pricing in the face of stochastic supply. First, a simple supply model is given which yields optimal prices, carryover and capacity. This model has little direct application except when the variance in runoff is small due to the stochastic nature of water supply. Secondly, a stochastic model with stochastic supply and determinate demand is given with each year treated independently. For the summer period, welfare gain is maximized subject to maintenance of a certain security level of water in the reservoir. In practice, pricing is more complicated for the start of the winter because the impact on the following summer must be considered. Since the amount of security which is provided is determined by value judgment, the stochastic model in practice is complex since it is influenced by social choice. (Siegenthaler-Rutgers)
W71-02647

RELATIVE ECONOMICS OF ANIMAL WASTE DISPOSAL BY SELECTED WET AND DRY TECHNIQUES,
Resource Engineering Associates, Inc., Stamford, Conn.
For primary bibliographic entry see Field 05D.
W71-02743

6D. Water Demand

DAVISON V CITY OF ANN ARBOR (FAILURE OF PROOF THAT LOWERING OF WATER TABLE WAS DUE TO OTHER THAN NATURAL CAUSES).
For primary bibliographic entry see Field 06E.
W71-02378

ANDES V ANDES (WATER RIGHTS SUBJECT TO LEASEHOLD).
For primary bibliographic entry see Field 06E.
W71-02379

ESSEX CO V GIBSON (MEASUREMENT OF WATER RIGHTS FOR MILL USE).
For primary bibliographic entry see Field 06E.
W71-02528

STATE EX REL CRABBE V MIDDLETOWN HYDRAULIC CO (RESERVATION OF DIVERSION RIGHTS).
For primary bibliographic entry see Field 06E.
W71-02532

ADVANCE PLANNING SUCCESS IN CHICAGO,
Chicago Dept. of Water and Sewers, Ill.
For primary bibliographic entry see Field 06B.
W71-02630

6E. Water Law and Institutions

GOVERNMENTAL ADMINISTRATION OF WATER RESOURCES IN THE CHICAGO METROPOLITAN AREA.
Northeastern Illinois Metropolitan Area Planning Commission, Chicago.

Public Administration Service, Chicago, Ill., 1963. 92 p, 9 map, 8 tab, 5 append.

Descriptors: *Planning, *Water resources development, *Administration, *Coordination control, Financing, Water supply, Sewage disposal, Flood control, Drainage, Multiple-purpose projects, Federal government, State governments, Interstate, Cities, Legislation.
Identifiers: *Water resources management, Water resources research, Counties, Special districts.

Management of water resources in the Chicago metropolitan area is studied with emphasis on problems of coordination and cooperation among governmental jurisdictions. The work is intended to serve as guide and precedent for similar action in other urban complexes. At the same time water resources management in other states and metropolitan areas is reviewed in order to gain some insight into how this area's problems can be solved. The area is first described in terms of its population growth past and present, its number and types of local governments, and those state and federal agencies concerned with water resources. Next, water resource facilities are described and mapped with present or anticipated problems outlined. Discussed are water supply systems, sewerage systems, flood control and drainage and other water uses and facilities including multipurpose facilities. Planning research, development, and financing are discussed from all levels from federal activity to municipal activity with interstate activity and special districts included. Federal influence and State, County, and Municipal controls are described and water management operations reviewed. In order for management to be effective, coordination among all levels is necessary with consideration of the overall water resources picture. Present sources of policy determination, judgement of operational effectiveness and need for comprehensive reporting are pointed out. Recommendations are made regarding implementation needs, intergovernmental cooperation, planning and financing, and legislative action. All levels of government are included with discussion regarding those levels needing strengthening. (Preckwinkle-Chicago)
W71-02204

SHERIFF V CITY OF EASLEY (RIGHT TO FLOW OF UNCONTAMINATED STREAM THROUGH PRIVATE PROPERTY).

183 SW 311-318 (SC 1936).

Descriptors: *South Carolina, *Pollutants, *Condemnation, *Sewage treatment, Eminent domain, Treatment, Natural flow, Sewage, Damages, Real property, Land, Cities, Streams, Reasonable use, Land use, Pastures, Farms, Compensation, Effluents, Water pollution, Natural use, Sewage disposal, Sewage effluents, Legal aspects, Judicial decisions, Municipal wastes.

Plaintiff landowner brought action against defendant city for permanent damages to her real property. Defendant had discharged pollutants and sewage into a stream which ran through plaintiff's land. Plaintiff maintained that she was entitled to the uninhibited, pure, and natural flow of the stream which ran through her land. Plaintiff contended further that defendant had made an unreasonable use of the stream and had deprived her of the ordinary use of her land for farming, pasturage, and as a residential site. Plaintiff concluded such use by defendant had amounted to the taking of her property without compensation. Defendant city contended that the sewage in the stream had been treated adequately and that the effluent did not cause any injury or damages to plaintiff's land. The court found that defendant had polluted the stream, thereby depriving plaintiff of the ordinary and reasonable use of her property. The court stated that such action by defendant had amounted to the condemnation of plaintiff's land. Therefore, the court held defendant had a duty to make just compensation to plaintiff for the property so taken. (Finman-Florida)
W71-02273

OGUNQUIT BEACH DIST V PERKINS (LOW WATER MARK AS BOUNDARY OF PROPERTY ADJACENT TO THE OCEAN).
21 A2d 660-664 (Me 1941).

Descriptors: *Maine, *Boundary disputes, *Low water mark, *Caosts, Oceans, High water mark, Atlantic Ocean, Littoral, Boundaries (Property), Legal aspects, Shores, Judicial decisions, Relative rights, Real property.

Plaintiff brought action to recover a parcel of land claimed by defendant. The controversy centered around the location of the dividing line between plaintiff's and defendant's property. Plaintiff contended that properties in dispute, being adjacent to the Atlantic Ocean, were to be measured by considering the properties' eastern boundary as the low water mark of the ocean. Defendant contended that the properties' eastern boundary was the high water mark of the ocean. The court held that when the deed of property adjacent to the ocean designates a boundary as 'the see' or 'the ocean', then the boundary extends to the low water mark. Since plaintiff's deed contained such a designation, the trial court's judgment for defendant was reversed. (Snow-Florida)
W71-02274

APPLICATION OF GILLESPIE (COMPENSATION FOR DAMAGE CAUSED BY INCREASE IN VOLUME OF FLOW).
265 App Div 239, 38 NYS 2d 612-616 (App Div 1942).

Descriptors: *New York, *Eminent domain, *Compensation, *Flow augmentation, municipal water, Judicial decisions, Legal aspects, Condemnation value, Easements, Cities, Flow control, Railroads, Embankments, Water distribution (Applied), Engineering structures, Civil engineering, Industrial water, Aqueducts, Reservoirs, Damages, Channel erosion.

Pursuant to the acquisition of a right to increase the flow of a creek abutting respondent railroad's property, petitioners, members of the Board of Water Supply, conveyed reservoir water into the creek. The addition of such reservoir waters eroded the natural banks of the creek and respondent's railroad embankments. Respondent appealed the report of the Commissioners of Appraisal which fixed only a nominal award for damages to the railroad embankments. Petitioners contended the awards should be nominal because the necessary reinforcement of respondent's embankments against normal stream flow would take care of the insignificant damage caused by the induction of reservoir water into the creek. The court, in granting respondent's motion to set aside the Commissioners' report, held that the award for damages was not just compensation. The court reasoned that petitioners must bear the portion of such burden caused by the increase in volume of flow and that awards of nominal damages did not meet such requirement. (Powell-Florida)
W71-02295

CHELTENHAM AND ABINGTON SEWERAGE CO V PUBLIC SERVICE COMM'N (OWNERSHIP OF STORM DRAINAGE SYSTEM).
311 Pa 175, 166 A 649-652 (1933).

Descriptors: *Pennsylvania, *Storm drains, *Surface runoff, *Use rates, Natural streams, Storm runoff, Urbanization, Drainage systems, Sewers, Clay pipes, Tiles, Streams, Marshes, Administrative decisions, State governments, Rates, Judicial decisions, Legal aspects, Regulation, Supervisory control (Power).

Plaintiff sewerage company appealed an order of defendant Public Service Commission which denied plaintiff's request for permission to charge for storm drainage service. Plaintiff's predecessor had installed conduits in streambeds to form a storm drainage system for a subdivision. A sewerage system was also installed by plaintiff's predecessor, separately and disconnected from the storm drainage system. Defendant contended that plaintiff did not own the storm system. The court determined that a conveyance to plaintiff by the subdivision promoter included only the sewerage system, and that if the storm system had been included, charges could not be exacted for its use, since the storm system was merely a substitute for natural drains. Property owners have a right to use artificial conduits for drainage of surface waters formerly carried away by natural streams. Furthermore, the court noted that there was meager evidence of maintenance of the storm system or other indicia of ownership. The court held that plaintiff did not own the storm drainage system and consequently could not charge for its use. (Hart-Florida)
W71-02309

HARVEY REALTY CO V BOROUGH OF WALLINGFORD (RIPARIAN RIGHTS AND PROTECTION OF PUBLIC WATER SUPPLY).
150 A 60-64 (Conn 1930).

Descriptors: *Connecticut, *Riparian rights, *Water supply, *Water pollution, Watercourses (Legal), Water utilization, Water policy, Legal aspects, Judicial decisions, Condemnation, Ponds, Streams, Water quality, Public rights, Public health, Relative rights, Competing uses, Reasonable use, Usufructuary right, Damages, Administrative agencies, Reservoirs, Legislation, Water pollution control.

Plaintiff realty company sought damages and an injunction restraining defendant borough from interfering with plaintiff's sale of land, along with bathing privileges, in a pond used by defendant as a source of water supply. Defendant counterclaimed and sought to restrain plaintiff from rendering such

water unfit for supply purposes. The trial court found the pond to be a reservoir within the meaning of a statute which prohibited bathing in and polluting reservoirs. The Supreme Court of Errors of Connecticut affirmed the trial court's judgment for defendant. Plaintiff had reserved land bordering the pond for use as a public park. Plaintiff's grantees were not riparian owners and consequently were not entitled to bathing privileges. Plaintiff's grant of public and private bathing privileges would have constituted an unreasonable use of the water. Riparian owners are limited to reasonable use of waters with due regard to the rights and necessities of other riparian proprietors. Riparian rights can only be claimed by a riparian owner, and an owner has no property in the water itself but a simple usufruct while such water passes along. The court's application of these general rules indicated that plaintiff's contemplated sales were extraordinary and unreasonable. (Duss-Florida)
W71-02314

CHICAGO MILL AND LUMBER CO V TULLY (TITLE TO ACCRETED LANDS).
130 F2d 268-276 (8th Cir 1942).

Descriptors: *Boundaries (Property), *Arkansas, *Accretion (Legal aspects), *Boundary disputes, Mississippi River, Rivers, Lumbering, Meanders, Islands, Bayous, Navigable waters, Drainage, Watersheds (Basins), Channels, Avulsion, Alteration of flow, Erosion, Maps, Riparian land, Water levels, Diversion.

Plaintiff lumber company brought suit to quiet title to certain lands allegedly accreted to other land owned by plaintiff. Defendant alleged that said lands were an accretion to lands in which defendant had legal title. The trial court appointed a master to determine the facts. The master found for defendant and the Court of Appeals, Eighth Circuit, affirmed. The court found that the land in question had been built up by accretion and not by avulsion. Whether such accreted lands were part of defendant's land or plaintiff's land was a question of fact for the master. The court found that there was no abuse of discretion in the master's finding. (Barnett-Florida)
W71-02315

NORTHERN IND POWER CO V CASTOR (ACQUISITION OF PRESCRIPTIVE RIGHT TO FLOOD LAND).
156 NE 571-574 (Ind 1927).

Descriptors: *Indiana, *Obstruction to flow, *Prescriptive rights, *Flood damage, Floods, Flooding, Backwater, Overflow, Dams, Levees, Rivers, Streamflow, Powerplants, Construction, Damages, Banks, Farms, Land tenure, Watercourses (Legal), Legal aspects, Judicial decisions.

Plaintiff farm owner sought to recover damages from defendant power company for the flooding of his land. Defendant had constructed a dam below plaintiff's land so that water backed up and flooded his property. Plaintiff alleged that construction of the dam was unlawful, was done without plaintiff's consent and was completed without a payment or tender of damages to him. Defendant contended that it had a prescriptive right to maintain the dam by virtue of the fact that there had previously been three dams in the same location, all of which had flooded plaintiff's land. Defendant admitted that flooding by the third dam had been reduced because of damages to it for some years prior to construction of the present dam. The jury returned a verdict for plaintiff, and the Appellate Court of Indiana affirmed. The court held that a prescriptive right to flood land is measured by the extent the right is exercised, in the instant case extending as far onto plaintiff's land as was habitually overflowed. Such a right and its exercise was properly a question for the jury. (Duss-Florida)
W71-02316

COLLINS V GERHARDT (OWNERSHIP OF BEDS OF NAVIGABLE RIVER SUBJECT TO RIGHTS OF NAVIGATION IN PUBLIC).
237 Mich 38, 211 NW 115-128 (1926).

Descriptors: *Michigan, *Navigation, *Ownership of beds, *Public rights, Navigable waters, Boundaries (Property), Riparian land, Riparian waters, Riparian rights, Damages, Judicial decisions, Legal aspects, Relative rights, Fishing, Patents, Grants, Beds under water, Land tenure.

Plaintiff owned land on either side of a river. He claimed that the part of the river which flowed through his land was his own and that he owned exclusive fishing rights therein. Plaintiff brought action in trespass against defendant for violating his alleged fishing rights. Defendant contended that the river was navigable, and therefore all rights of ownership in plaintiff were subject to the public's rights of fishing and navigation. The court applied the floatage test and declared the river to be navigable. An owner having title to land on either side of a navigable river owns the soil thereunder. However, the common law doctrine that the right of fishery follows the ownership of the beds was rejected by the court. Title to the beds is held subject to the rights in the public of navigation and fishery, whether held by the state or a private citizen. The trial court's judgment for plaintiff was reversed. (Price-Florida)
W71-02317

MORGAN V KLOSS (CONSTRUCTION OF BRIDGE TO ISLAND IN NAVIGABLE LAKE FOR PRIVATE PURPOSES).
244 Mich 192, 221 NW 113-114 (1928).

Descriptors: *Michigan, *Islands, *Navigable waters, *Bridge construction, Lakes, Bridges, Administrative agencies, Administrative decisions, State governments, Navigation, Depreciation, Riparian land, Legislation, Judicial decisions, Legal aspects, Regulation.

Plaintiff littoral landowners brought action to enjoin defendant from building a bridge from the lakeshore to an island. Plaintiffs contended that the bridge would be a nuisance, inhibit navigation, and depreciate their property values. Defendants had obtained permission from the board of county supervisors to erect the bridge. The court determined that the bridge would unquestionalbly hamper navigation. Furthermore, the court stated that authority to erect bridges over navigable waters for private purposes must be explicitly granted by the legislature. Finding no such authority to erect bridges over navigable lakes, the court held that the consent given by the county was ultra vires, and affirmed the lower court's decree enjoining construction of the bridge. (Hart-Florida)
W71-02318

FOX RIVER PAPER CO V RAILROAD COMM'N (ACQUISITION OF LICENSE FOR DAM OPERATION).
208 NW 266 (Wis 1926).

Descriptors: *Wisconsin, *Legislation, *Permits, *Dams, Navigable waters, Regulation, Cities, State governments, Railroads, Administrative agencies, Structures, Water works, Compensation, Eminent domain, Administrative decisions, Supervisory control (Power).

Plaintiff brought action to review an order of defendant Railroad Commission denying plaintiff a permit to operate an existing dam which was constructed without legislative authority. Defendant denied the permit on the ground that the provision of the statute requiring the applicant to consent to valuation and condemnation proceedings prescribed therein, in the event that the property be taken over by the state, was not included in plaintiff's application for a permit. Plaintiff alleged that the provision was unconstitutional and that defendant had no right to require such a consent as a condition precedent to its entertaining and considering the application. The Supreme Court of Wisconsin affirmed the lower court's holding that the law was constitutional (Barnett-Florida)
W71-02320

SOUTHERN RY V THACKER (LIABILITY FOR OBSTRUCTING PROPERTY'S NATURAL DRAINAGE).
179 SE 225-228 (Ga 1935).

Descriptors: *Georgia, *Obstruction to flow, *Ditches, *Drainage, Overflow, Watercourses (Legal), Damages, Land tenure, Embankments, Erosion, Flow, Ponds, Construction, Surface waters, Surface runoff, Surface drainage, Railroads, Washouts, Gullies, Legal aspects, Judicial decisions.

Defendant railroad had constructed an embankment which obstructed the natural drainage of plaintiff's property. It constructed a ditch to compensate for this but failed to keep it cleared out so that water backed onto plaintiff's property. Plaintiff sought to recover damages for such flooding. Defendant contended that the cause of action was based on its construction of the embankment and that it owed no duty to plaintiff regarding the embankment. The trial court found for plaintiff, and the Court of Appeals of Georgia affirmed. Defendant owed a duty to plaintiff to keep the ditch clear so that water would be drained off. The court held that it was clear that the action was based on defendant's failure to keep the ditch unobstructed. Plaintiff was only limited in her recovery to damages which occurred within four years of the filing of suit. (Duss-Florida)
W71-02321

HUMPHRIES V BLACK BETSEY CONSOL COAL CO (LIABILITY FOR FLOOD DAMAGES DUE TO DIVERSION OF STREAM).
178 SE 273-276 (W Va 1934).

Descriptors: *West Virginia, *Diversion, *Channels, *Flood damage, Watercourses (Legal), Floods, Beds, Roads, Road construction, Flow, Legal aspects, Judicial decisions, Adjudication procedure, Construction, Damages, Channeling, Channel flow, Flooding.

Plaintiff landowner sought to recover for flood damages from defendants coal company and county court. Plaintiff alleged that the damages resulted because defendants changed a normal creek channel so that it ran nearer to his property. This change was caused by defendants' construction of a road. Defendant coal company contended that it constructed the road under an agreement with the county court that the county would take over the road. It alleged the road did not constitute an imminent danger to plaintiff and that once such road was taken over by the county, its responsibility ended. The jury found against defendant coal company and for defendant county court, and the Supreme Court of Appeals of West Virginia affirmed. The court held that the agreement between the coal company and county court was unlawful and that the coal company could not escape liability for diverting the stream on the ground of an employer-independent contractor relationship. The court further held that defendant coal company could not escape liability because the county court took over the road before the damages occurred since the diversion caused the damages. One judge dissented. (Duss-Florida)
W71-02322

PORT UTIL COMM'N V MARINE OIL CO (LIABILITY FOR RENT WHERE WATER DEPTH NOT MAINTAINED).
175 SE 818-321 (SC 1934).

Descriptors: *South Carolina, *Leases, *Docks, *Water levels, Depth, Damages, Contracts, Legal aspects, Judicial decisions, Administrative agen-

cies, Relative rights, Adjudication procedure, Remedies, Rent.

Plaintiff utilities commission sought to eject defendant oil company from a wharf for nonpayment of rent. Plaintiff's and defendant's rental agreement called for a minimum depth in the wharf's slip at low tide. Defendant contended that this minimum depth was never maintained by plaintiff and that this breach amounted to a total eviction from a portion of the premises. Therefore, defendant contended that its liability for the rent was suspended. The Supreme Court of South Carolina, in affirming the lower court's decision for plaintiff, held that defendant's contention was not the rule in South Carolina. There can be no eviction unless a tenant actually possesses the premises from which he claims eviction. Defendant never possessed the depth of water. Secondly, defendant was in possession of the premises before the contract was signed. The clause concerning the depth was in the nature of a promised improvement, and plaintiff's failure to perform did not entitle defendant to refuse payment or vacate the premises. Defendant's remedy would have been an action for damages. (Duss-Florida)
W71-02323

COLLINS MFG CO V WICKWIRE SPENCER STEEL CO (UPPER RIPARIAN PROPRIETOR MAY NOT POLLUTE WATER TO THE INJURY OF LOWER RIPARIAN PROPRIETOR).
14 F2d 871-874 (D Mass 1926).

Descriptors: *Massachusetts, *Water pollution, *Pollution abatement, *Riparian rights, Damages, Remedies, Artificial use, Legal aspects, Judicial decisions, Industries, Water reuse, Industrial wastes, Relative rights, Recirculated water, Prior appropriation, Running waters, Streams, Industrial water.

Plaintiff corporation sought to restrain defendant corporation from polluting the waters of the river which flowed through the land of both parties. Plaintiff contended that defendant upper riparian proprietor could not use the waters of the river in such a way as to pollute it to the injury of plaintiff lower riparian proprietor. Defendant contended that plaintiff's claims were too general and did not entitle him to equitable relief. The court held that no riparian proprietor has the right to use the waters of a natural stream for such purposes as would materially corrupt it to the substantial injury of a lower proprietor. Although plaintiff's complaint was very broad, the court found that it warranted equitable relief. (Quesada-Florida)
W71-02324

DAVIS V GULF AND I RY OF TEXAS (SHALLOW AND CROOKED STREAM NOT NAVIGABLE WATERWAY).
31 F2d 109-110 (5th Cir 1929).

Descriptors: *Texas, *Navigable waters, *Navigation, *Bridges, Transportation, Running waters, Streams, Surface waters, Federal government, Remedies, Legislation, Judicial decisions, Legal aspects, Shallow water, Marshes, Barriers.

Plaintiff railroad company sought to enjoin the enforcement of a penalty against it by defendant Secretary of War. The penalty arose from a finding by defendant that plaintiff's bridge was obstructing the navigability of what defendant had determined to be a navigable stream. Plaintiff contended that the stream was merely a drain in a salt marsh, shallow and crooked, and therefore not navigable. Defendant contended the stream was navigable in fact and therefore he was authorized by federal law to penalize plaintiff for obstructing the stream's navigability. The United States Circuit Court of Appeals held that the test of navigability is whether a waterway in its natural state is capable of affording a highway for useful commerce. The court found that the stream was not navigable under this test and upheld an injunction. (Quesada-Florida)
W71-02325

OZARK PIPE LINE CORP V DECKER (LIABILITY FOR STREAM CONTAMINATION BY OIL).
32 F2d 66-69 (8th Cir 1929).

Descriptors: *Missouri, *Damages, *Pollutants, *Water pollution sources, Piping systems (Mechanical), Pipes, Pipelines, Hydraulic structures, Remedies, Legal aspects, Judicial decisions, Springs, Subsurface waters, Water sources, Oil, Oily water.

Plaintiff landowner brought an action for damages against defendant oil corporation based on an alleged oil leak from defendant's pipeline which ran through plaintiff's land. Plaintiff contended that the leakage had caused a spring on his property to become polluted. Defendant contended that there was no evidence from which it could be found that the condition of the spring was attributable to any act or neglect on its part. Defendant maintained that the oil in the spring water could have come from oil that had been in the ground for a number of years. The court held that in order to support a judgment for damages evidence must show more than a mere possibility of contamination from oil pipeline leakage. The trial court's judgment for plaintiff was reversed. (Quesada-Florida)
W71-02326

HODGES V TOWN OF BLUFF CITY (ACQUISITION OF WATER RIGHTS).
32 F2d 779-780 (6th Cir 1929).

Descriptors: *Tennessee, *Municipal water, *Water rights, *Water sources, Springs, Running waters, Spring waters, Legal aspects, Remedies, Judicial decisions, Beneficial use, Reasonable use, Relative rights, Consumptive use, Water demand, Water distribution (Applied), Water supply.

Plaintiff landowner sought to enjoin defendant city from taking water from a spring for municipal purposes. Plaintiff claimed the right to the waters from the spring under a quitclaim deed made out to his vendor and the vendor's sons. Plaintiff contended that his vendor was the grantee of the rights to the spring and therefore those rights had passed to him. Defendant contended that plaintiff had been conveyed only the interests of the vendor and not those of the two sons named in the quitclaim deed. Defendant maintained that it was the successor to the two sons' interest and thus it had a right to two-thirds of the spring water. The court held that one taking under a quitclaim deed conveying water rights to himself and two others was entitled to only a one-third interest in the water of the spring. (Quesada-Florida)
W71-02327

WABASH RR V LEWIS (LIABILITY FOR FLOODING CAUSED BY INSUFFICIENT DRAINAGE THROUGH RAILROAD EMBANKMENT).
48 F2d 519-523 (8th Cir 1931).

Descriptors: *Missouri, *Flooding, *Obstruction to flow, *Flood damage, Backwater, Drainage water, Damages, Floodwater, Floods, Overland flow, Rain, Rain water, Runoff, Storm runoff, Excessive precipitation, Drainage, Surface drainage, Surface waters, Flow, Judicial decisions, Railroads, Surface runoff, Drains, Embankments, Legal aspects.

In an action for damages, plaintiff contended that defendant railroad company had constructed a railroad bed embankment and had failed to provide a sufficient opening through such embankment for the drainage of surface waters. As a result, plaintiff contended drainage waters from a rainfall were obstructed in their natural flow and were caused to back up onto plaintiff's property, thereby flooding and damaging such property. Defendant contended that the rainfall was extraordinary and that its failure to provide drainage through its embankment was not a proximate cause of the flooding. The court stated that where rains are unprecedented, one obstructing flow will not be held liable if the unprecedented rainfall is the sole cause of damage. However, the court held that the evidence indicated that the rainfall was not extraordinary. The court thus ruled that defendant was liable for the damages resulting from its failure to provide for adequate drainage of surface waters. (Snow-Florida)
W71-02328

WILLARD V STONE (EASEMENT FOR WATER SUPPLY MEANS REASONABLE USE OF ALL WATER ON SERVIENT PROPERTY).
253 Mass 555, 149 NE 681-684 (1925).

Descriptors: *Massachusetts, *Springs, *Easements, *Water supply, Reservoirs, Contracts, Judicial decisions, Legal aspects, Remedies, Water sources, Reasonable use, Spring waters, Watercourses (Legal), Droughts, Low flow, Piping systems (Mechanical), Hydraulic structures, Supply contractors, Water contracts, Usufructuary right.

Plaintiff sued to enjoin defendant adjoining landowner from interfering with plaintiff's right to take water from springs on defendant's land. Plaintiff's grantor had obtained an easement to take the water from defendant's grantor and had installed on defendant's land pipes to spring A, a dam, a reservoir and hydraulic rams. Later, after an oral agreement, plaintiff's grantor installed pipes to spring B but did not make some other improvements that he and defendant had agreed to. Later, defendant constructed a second reservoir and connected spring B to it, and during a subsequent drought, the water in spring A was diminished. Defendant questioned whether plaintiff had a right to water from spring B because of the failure of his grantor to fulfil the oral agreement. Defendant also contended that plaintiff had abandoned his easement. The Supreme Judicial Court of Massachusetts, in affirming a decree for plaintiff, held that the original contract entitled plaintiff to use of all the water he reasonably needed from all the springs and the right to do what was necessary to obtain such water. Such right was not abandoned unless abandonment was clearly intended by the owner of the right. (Morris-Florida)
W71-02329

NORFOLK AND W RY V MCCOY (LIABILITY OF RAILROAD FOR RIVERFILL CAUSING OVERFLOW).
257 Ky 32, 77 SW2d 392-394 (1934).

Descriptors: *Alteration of flow, *Railroads, *Floods, *Kentucky, Overflow, Diversion, Obstruction to flow, Streamflow, Barriers, Piles (Foundations), Flow, River flow, Beds, Rivers, River beds, Judicial decisions, Damages.

In an action for damages to land, plaintiff contended that defendant railroad company was liable for overflow of a river onto plaintiff's land. Plaintiff maintained that such overflow was the result of a railroad fill in the river bed upstream from plaintiff's land. The fill allegedly diverted the river from its natural course onto plaintiff's property. Defendant contended that the fill was not the cause of the overflow, but that such overflow was the result of seasonal high waters. The court held that plaintiff had failed to introduce sufficient evidence to establish that the overflow was a result of the fill. Accordingly, plaintiff was denied recovery. (Snow-Florida)
W71-02330

HORTON V NIAGARA, LOCKPORT AND ONTARIO POWER CO (OWNER OF BANK OWNS TO THREAD OF CHANNEL).
231 App Div 386, 247 NYS 471-755 (1931).

Descriptors: *New York, *Boundaries (Property), *Islands, *Banks, Ownership of beds, Legal aspects, Judicial decisions, Remedies, High water mark, Real property, Watercourses (Legal), Water

level fluctuations, Streamflow, Riparian land, Riparian waters, Boundary disputes, Channels, River beds, Condemnation, Damages, Eminent domain, Hydroelectric plants.

Plaintiff, who claimed to own land on both sides of the Salmon River as well as an island in the middle of such river, sought an injunction to require removal of defendant hydroelectric company's power plant and transmission lines from the shores of the river. Defendant contended that plaintiff's predecessor in title had sold the shores to defendant's predecessor in title, the deed specifying 'the land between the brink of the two banks' of the river which flowed down a steep gorge. The court affirmed a referee's finding for defendant as to ownership of the shores on both sides of the river. The court found the deed intended to give defendant title to the top of the precipice on each side of the gorge rather than the mere high water mark of the river. As to ownership of the island, the court found a previous case was res judicata in plaintiff's favor. Since defendant could condemn the island, the court ordered defendant to pay for encroachment of its transmission lines on the island. The court found the power plant did not encroach in the island because it was on the mainland side of the thread of the stream, and defendant's title extended to such thread. (Morris-Florida)
W71-02331

KELLY V NAGLE (RIPARIAN RIGHT TO THE NATURAL FLOW OF A STREAM).
132 A 587-594 (Md 1926).

Descriptors: *Maryland, *Riparian rights, *Reasonable use, *Natural flow, Alteration of flow, Competing uses, Diversion, Relative rights, Riparian land, Riparian waters, Severance, Streamflow, Flow, Streams, Springs, Judicial decisions, Spring waters, Pipes, Easements, Land tenure, Water rights.

Plaintiff sought to enjoin defendant from plugging up a pipe which carried water from a spring on defendant's land to plaintiff's non-riparian land. Plaintiff contended that defendant's predecessor in title had granted her the right to acquire spring water through such a pipe. Defendant contended that the grant of such a right was invalid. The court held that the grant had been an invalid exercise of defendant's predecessor's riparian rights. The court stated that a riparian owner cannot divert the waters of a spring in excess of that which he may make a reasonable use of upon his own land. Any other diversion by a riparian would violate the rights of lower riparians to the spring's flow. Defendant's predecessors' grant of the water to a non-riparian was thus putting the water to a use not associated with the riparian's land and as such was an unreasonable use of the spring's water. The grant to plaintiff was therefore invalid, and the court held that plaintiff was not entitled to an injunction. (Snow-Florida)
W71-02332

ROTH V STATE (LIABILITY FOR DROWNING CAUSED BY DEEPENING THE WATERS ADJACENT TO A PUBLIC BEACH).
262 App Div 370, 29 NYS2d 442-444 (1941).

Descriptors: *New York, *Drowning, *Beaches, *Dredging, Recreation facilities, Lakes, Recreation, River basin development, Boating, Swimming, Beds, Beds under water, Lake beds, Basins, Judicial decisions, State governments, Depth, Deep water, Excavation.

Plaintiff, decedent's executor, brought a wrongful death action against the state of New York for negligence which allegedly led to the drowning of decedent. Plaintiff contended that defendant created an unreasonable risk to bathers when it deepened the waters adjacent to a public beach. Plaintiff contended further that, as a result of defendant's acts, decedent, while swimming, stepped into the deepened area and drowned. The court held that the beds of the lake was held in trust by defendant for the people of the state. The public thus had a right to use the waters of the lake for recreation and enjoyment. The court held that defendant, in deepening the waters adjacent to the beach and failing to warn the public of the risk, created an unreasonable risk and would be held liable for injuries resulting from such negligence. The trial court's judgment for defendant was reversed. (Snow-Florida)
W71-02333

TENNESSEE VALLEY AUTHORITY V ASHWANDER (TVA'S AUTHORITY TO SELL POWER IN EXCESS OF THAT PUT TO GOVERNMENTAL USE).
78 F2d 578-583 (5th Cir 1935).

Descriptors: *Dams, *Hydroelectric plants, *Tennessee Valley Authority Project, *Hydroelectric power, Electric power, Electric power production, Electricity, Rivers, Navigable rivers, Navigable waters, Federal government, Administrative agencies, Judicial decisions, Transmission (Electrical), Claims (Contracts), Contracts.

In an action to rescind a contract, plaintiff power company contended that a contract made with the Tennessee Valley Authority was invalid as being an ultra vires act by the Authority. Plaintiff contended that selling its power transmission lines to the Authority was invalid in that the lines were going to be used for an illegal proprietary operation--that the Authority was going to sell power, in excess of government requirements, to private parties. Plaintiff contended that such would be outside the government's authority under the commerce clause. Defendant contended that the selling of the excess power was consistent with its authority under the commerce clause to build dams on navigable rivers. The Circuit Court of Appeals, Fifth Circuit, held that defendant, by virtue of lawful ownership of the dam, owned all the water power created by the construction of the dam. Defendant could thus dispose of water power as freely as it could dispose of any other governmental property. The Authority could thus sell the power in excess of governmental requirements. Such was not an ultra vires act. Therefore, the contract for the transmission lines was valid. (Snow-Florida)
W71-02334

UNITED STATES EX REL GREATHOUSE V HURLEY (FEDERAL GOVERNMENT'S DISCRETIONARY POWER TO ISSUE WHARF PERMITS IN THE DISTRICT OF COLUMBIA).
63 F2d 137-147 (DC Cir 1933).

Descriptors: *Docks, *Ownership of beds, *Riparian rights, *District of Columbia, Navigable rivers, Beds, Beds under water, River beds, Riparian land, Navigable waters, Rivers, Rivers and Harbors Act, Virginia, Maryland, Relative rights, United States, Federal government, Judicial decisions, Federal jurisdiction, Permits, Navigation.

Plaintiffs sought a writ of mandamus to compel the Secretary of War to issue a permit for the construction of a wharf in the Potomac River. Plaintiffs contended that, under a 1785 compact between Maryland and Virginia, they had acquired such property rights to the bed of the Potomac River as to entitle them, as a matter of right, to a permit. Defendant contended that the compact was not applicable to property now within the District of Columbia. Instead, defendant contended, navigable waters were subject to the plenary regulatory power of Congress and the issuance of a permit by the Secretary of War was merely a discretionary act. The court held that the ceding of the District of Columbia by Virginia to the federal government terminated any privilege which Virginia had given to the riparian owners to make use of its bed. The control of the river and its bed is subject to the plenary power of Congress. As a result, the Secretary of War can issue permits for wharf construction at his discretion and mandamus will not lie for discretionary acts of this nature. (Snow-Florida)
W71-02335

SMITH V STASO MILLING CO (DOCTRINE OF COMPARATIVE HARDSHIP NOT APPLICABLE WHERE POLLUTER FOREWARNED OF POLLUTION DANGER).
18 F2d 736-739 (2nd Cir 1927).

Descriptors: *Vermont, *Water pollution, *Industrial wastes, *Pollution abatement, Relative rights, Sludge disposal, Wastes, Streams, Running waters, Damages, Remedies, Legal aspects, Judicial decisions, Water pollution sources, Riparian rights, Adjudication procedure.

Plaintiff lower riparian landowner sought to enjoin defendant slate grinding corporation from polluting, with slate dust and sludge, a brook running through his land. Plaintiff contended that defendant had been warned by him before building its mill and that defendant had assured him it would not defile the brook. Contending that defendant ignored the warnings and broke its promise, plaintiff sought to enjoin defendant's operation ad to collect for blasting damages. Defendant contended that it had installed dust arresters and had done all possible to prevent the pollution. The United States Circuit Court of Appeals held that, in light of the explicit warning given by plaintiff and defendant's promise, the burden of successfully avoiding pollution of the brook fell upon defendant. In considering the doctrine of balancing comparative hardships, the court found that plaintiff's forewarning and defendant's promise favored the issuance of the injunction. (Quesada-Florida)
W71-02336

CENTRAL OF GEORGIA RY V FAULKNER (LIABILITY FOR CHANGE IN EXISTING DRAINAGE PATTERN).
114 So 686-688 (Ala 1927).

Descriptors: *Alabama, *Surface drainage, *Railroads, *Prescriptive rights, Alteration of flow, Right-of-way, Transportation, Embankments, Highways, Roads, Judicial decisions, Legal aspects, Damages, Surface waters, Natural flow, Drainage, Surface runoff, Riddance (Legal aspects), Diversion.

Plaintiff, who owned land fronting on defendant railway's right-of-way, sued for damages after defendant widened the embankment on the right-of-way. Plaintiff claimed the action destroyed a public road which led to plaintiff's land and diverted surface waters onto plaintiff's property. Defendant contended the roadway was not a public road, because defendant had not received notice of a hostile public claim that would lead to prescription, and argued that a superior proprietor was under no duty to maintain drains to prevent natural flow onto servient lands. The Supreme Court of Alabama, reversing a decision for plaintiff, held that open, continuous, public use of a highway for 20 years creates a prescriptive right unless the landowner establishes that the use is permissive and not hostile. Such a prescriptive right may be obtained over a railroad's right-of-way. Also, if the embankment altered the existing drainage pattern, defendant would be liable for diverting surface waters onto plaintiff's land. (Morris-Florida)
W71-02337

COVINGTON V CASSIDY BAYOU DRAINAGE DIST (RIPARIAN OWNERS' RIGHT TO, THROUGH A DRAINAGE DISTRICT, PROTECT AGAINST FLOOD BY OBSTRUCTION OF A WATERCOURSE).
122 So 205-216 (Miss 1929).

Descriptors: *Mississippi, *Bayous, *Drainage districts, *Dams, Judicial decisions, Legal aspects, Remedies, Watercourses (Legal), Contracts, Floods, Engineering structures, Rains, Excessive precipitation, Natural flow, Streamflow, Riparian land, Riparian rights, Obstruction to flow, Repulsion (Legal aspects).

Plaintiff landowners sought an order requiring defendant drainage district to remove a dam on a bayou, claiming it caused flooding of their land in times of excessive rains. Plaintiff had obtained a temporary injunction against construction of the dam when it was first proposed, but the injunction was dropped when both parties signed a consent decree calling for location of the dam elsewhere at plaintiff's expense. Defendants contended that plaintiffs refused to comply with the decree and that, since the bayou was not a natural watercourse, it could be dammed. The Supreme Court of Mississippi, in affirming a decision for defendant, held plaintiff had abandoned its opposition to the damsite by failure to comply with the consent decree. The court also indicated that while there was ample evidence to support the lower court's finding that the bayou was only a watercourse during flooding, such a finding was not necessary. The general rule that riparian proprietors are to be protected against obstructions causing damage does not hold true when other proprietors, through a drainage district, erect works to protect themselves against flooding. One judge dissented. (Morris-Florida)
W71-02338

UNITED STATES V OREGON (OWNERSHIP OF BEDS OF NAVIGABLE AND NON-NAVIGABLE WATERS).
295 US 1, 55 S Ct 610-622 (1935).

Descriptors: *Oregon, *Non-navigable waters, *Lakes, *Ownership of beds, Boundaries (Property), Navigable waters, Federal government, State governments, Legislation, Judicial decisions, Legal aspects, Meanders, Political aspects, Lake beds, Recreation, Real property, Relative rights, Land tenure.

Plaintiff United States brought an action to quiet title to certain submerged lands situated under several connected lakes in defendant state. Plaintiff contended that at the time of defendant's admittance into the Union the lakes were non-navigable and therefore title to the beds remained in the United States. Plaintiff asserted that only title to submerged lands under navigable water passed to states upon their admittance to the Union. Defendant contended that the lakes were navigable upon its entrance into statehood and, in the alternative, that plaintiff had conveyed some riparian property to individuals, and thus the beds were owned by the state. The Supreme Court held that while title to lands underlying navigable waters passes to a state upon its admission to the United States, title to lands underlying non-navigable waters remains in the United States and that whether a grant by the United States of uplands bordering on non-navigable waters carries with it the title to the beds depends upon the intention of the grantor. The court noted that the laws of the United States alone control the disposition of the lands of the United States located within states, and states are powerless to place limitations on such control. (Quesada-Florida)
W71-02339

UNITED STATES V ARIZONA (CONGRESSIONAL AUTHORIZATION REQUIRED FOR FEDERAL DAM PROJECTS).
295 US 174, 55 S Ct 666-673 (1935).

Descriptors: *Arizona, *Dams, *Navigable waters, *Federal-state water rights conflicts, Federal government, State governments, Legal aspects, Legislation, Damsites, Beneficial use, Electric power, Water resources development, Projects, Project purposes, Planning, Judicial decisions, Colorado River, United States, Regulation, Dam construction.

Plaintiff United States sought an injunction to prevent defendant state from interfering with a federal dam project on the Colorado River. Plaintiff contended that the dam project was authorized by Congresss under its power over navigable waters. Defendant contended that while Congress had power over navigable waters, it had not authorized the project in question. Defendant further maintained that the Chief of Engineers had not authorized the project as was required by the National Industrial Recovery Act. The Supreme Court held that the project did not have proper congressional authorization. The United States could not enjoin interference by the state of Arizona as to the proposed dam where the construction of the dam was not properly authorized. (Quesada-Florida)
W71-02340

HILT V WEBER (OWNERSHIP OF LAND ALONG LAKE'S EDGE).
252 Mich 198, 233 NW 159-170 (1930).

Descriptors: *Michigan, *Accretion (Legal aspects), *Riparian rights, *Boundaries (Property), Land tenure, Eminent domain, Compensation, Lake Michigan, Navigable waters, Navigation, Beds, Ownership of beds, Boundary disputes, Damages, Public rights, Surveys, Riparian land, Legal aspects, Judicial decisions, Lakes, Great Lakes.
Identifiers: *Meander lines.

Plaintiffs filed a bill to foreclose a land contract on land bordering Lake Michigan. Defendants claimed fraud in that the boundary of ownership was an old meander line, and consequently relicted land belonged to the state. Defendants were awarded damages. The Supreme Court of Michigan reversed, holding that the shoreline and not the meander line was plaintiffs' true boundary. Under federal law, a purchaser from the government of public land on the Great Lakes took title to the water's edge. Meander lines had no force as boundaries to waters other than the Great Lakes. The court ruled that a prior case, holding that riparian owners on the Great Lakes owned only to the meander line and that the status of land as lake bottom was fixed by the meander line, was incorrect. All riparian owners own to the water's edge. Right to acquisitions to land through accession or reliction is a riparian right. Title to the shoreline is a movable freehold. The state cannot take private property without compensation, which would occur if relicted land were held to belong to the state. Generally, riparian rights are: (1) water utilization for general purposes; (2) to wharf out to navigability; (3) access to navigable waters; and (4) right to accretions. Such rights are property, and in taking them, the state must pay compensation. Such rights do not interfere with the state's paramount right to free and unobstructed use of navigable waters for navigation. (Duss-Florida)
W71-02341

SS KRESGE CO V RAILROAD COMM'N (RIGHT TO CONSTRUCT BUILDING ON BED OF STREAM).

235 NW 4-9 (Wis 1931).

Descriptors: *Wisconsin, *Navigable rivers, *Riparian rights, *Buildings, Administrative agencies, Easements, Public rights, Mississippi River, Navigation, Navigable waters, Beds, Legislation, Bridges, Dams, Water levels, Flow, Obstruction to flow, Permits, Riparian land, Judicial decisions, Legal aspects, Channels, Construction.

Plaintiff brought suit against defendant railroad commission to have declared its right to erect a building over the bed of a river. Plaintiff also sought to restrain defendant from objecting to the issuance of a permit for the erection of the building. Plaintiff alleged that the river was not navigable in that it: (1) had insufficient depth, (2) contained many natural obstructions, and (3) contained many man-made obstructions. The Wisconsin supreme court held, first, that the commission could not be enjoined from objecting to the granting of a permit, as this was a matter within its discretion. Secondly, the fact that the river was not presently navigable, did not mean that there would never be navigation of the river. It is well established that the right of a riparian in the bed of a stream is subject to a public easement of navigation, including the right to improve the stream's navigability. Plaintiff's rights were, therefore, subordinate to the right of the state, as trustee for the public, to improve navigation by eliminating obstructions. (Duss-Florida)
W71-02342

VAN CORTLANDT V NEW YORK CENT RR (PRIVATE RIGHT TO RELIEF FROM PUBLIC NUISANCE).
265 NY 249, 192 NE 401-406 (1934).

Descriptors: *New York, *Navigable waters, *Bridges, *Navigation, Navigable rivers, State governments, Railroads, Adjudication procedure, Legal aspects, Judicial decisions, Highways, Remedies, Damages, Legislation, Bridge design, Boats, Ships, Transportation, Bodies of water, Streams, Rivers, Costs.

Plaintiff riparian owner sought a judgment enjoining defendant railroad from maintaining a rigid bridge across a navigable stream. The lower court found the stream to be navigable and the bridge a public nuisance and impediment to navigation but held plaintiff's action to be barred by laches since the bridge had been in existence for forty years. Both parties appealed, plaintiff from the adverse judgment and defendant from the findings of navigability and nuisance. The Court of Appeals of New York affirmed the trial court's judgment. A delay of forty years did not bar plaintiff from enjoining a continuing nuisance, but did have bearing on the extent and materiality of plaintiff's injury. To maintain an action for a public nuisance plaintiff had to show some injury different in kind from that to the public at large. Removal of the instant bridge would have allowed navigation only to a post road crossing the stream 2400 feet upstream. Construction of a drawbridge and improvement of the channel would have cost $3,750,000. The court held that obstruction of navigation by defendant's bridge did not cause sufficient private damage to entitle plaintiff to relief. (Dye-Florida)
W71-02343

FREED V MIAMI BEACH PIER CORP (INFRINGEMENT OF OCEANFRONT RIGHTS).
112 So 841-846 (Fla 1927).

Descriptors: *Florida, *Riparian rights, *Navigable waters, *Boundaries (Property), Land, Real property, High water mark, Low water mark, Legal aspects, Judcial decisions, Docks, Coastal structures, Concrete structures, Piers, Shores, Beaches, Relative rights.

Plaintiff and defendant owned adjoining lots on the ocean front. Defendant obtained permits for and began to construct a pier extending into the water fronting its property. The pier was not constructed at a right angle to the shoreline and extended to some extent into the waters fronting plaintiff's property. Plaintiff sought to enjoin further construction, contending that the pier would obstruct the distant view from his property, which was occupied by a casino. The Supreme Court of Florida affirmed a judgment for defendant. Riparian owners on navigable waters have a right of access and a right to a reasonably unrestricted distant view. Riparian rights in the instant case extended not along extensions of the land lines but on lines at right angles to the high water mark from the corners of the lots. Defendant's pier extended across lines so drawn, but only a minor restriction of plaintiff's view resulted. Plaintiff's right of access was unimpaired. The court held that plaintiff's rights were not infringed to the extent necessary to justify relief at the state of construction defendant had reached. (Dye-Florida)
W71-02344

LAND V BROCKETT (TITLE TO UNMEANDERED PENINSULA).
162 La 519, 110 So 740-743 (1926).

Descriptors: *Louisiana, *Boundary disputes, *Boundaries (Property), *Meanders, Land tenure, Legal aspects, Judicial decisions, Land, Real property, Banks, Lakes, Shores, Lake shores, Navigable waters, Surveys, Estimating, Public lands.

Plaintiff, under a patent, held property bordering a lake. The survey of the patent excluded a 90-acre peninsula extending into the lake. Defendant fenced this peninsula and built a homestead and outbuildings thereon. Plaintiff sought to have himself declared owner of the peninsula, contending that his patent conveyed to the water line and thus included the peninsula. The Supreme Court of Louisiana reversed a judgment for plaintiff. Where a patent purports to convey to the water line, the water line is generally the boundary of the property conveyed, even if the meander line of the survey deviates therefrom. One exception to this rule, however, is in cases where the discrepancy is so great in comparison to the amount of land conveyed that it seems certain that not even an approximate meander of the shoreline was attempted. In the instant case 90 acres was omitted, and it could not be said that a meander was attempted. The land was public and open to entry for homestead purposes by defendant. (Dye-Florida)
W71-02345

KITCHING V BEACHLAND DEV CO (OWNERSHIP OF LAND BETWEEN SURVEY LINE AND NAVIGABLE RIVER).
117 So 789 (Fla 1928).

Descriptors: *Florida, *Surveys, *Boundary disputes, *Boundaries (Property), Judicial decisions, Legal aspects, Navigable rivers, Navigable waters, Measurement, Real property, Land tenure.

Defendant owned land, pursuant to a patent, that was located near a navigable river. Plaintiff possessed the unsurveyed land between defendant's tract and the river. Plaintiff brought an action, alleging that defendant was interfering with plaintiff's right of possession. Plaintiff alleged that he had taken appropriate steps to acquire the land under federal homestead laws. Defendant claimed the land occupied by plaintiff on the theory that the river water line, and not the survey line on his patent, was his boundary. The Florida supreme court held that defendant was not entitled to the land lying between the patent survey line and the navigable river. (Powell-Florida)
W71-02346

STATE V STANDARD OIL CO (VALIDITY OF OIL LEASE TO DRY LAKE BED).
164 La 334, 113 So 867-879 (1927).

Descriptors: *Louisiana, *Lake beds, *Leases, *Ownership of beds, Boundary disputes, Lakes, Navigable waters, Land tenure, Oil wells, Oil fields, Oil industry, Boundaries (Property), Drainage districts, State governments, Administrative agencies, Legal aspects, Adjudication procedure, Judicial decisions, Remedies, Shores, United States, Sea level, Surveys, Mapping.
Identifiers: Levee districts.

Plaintiff state sued defendant oil company to recover the value of oil produced by defendant's wells on a dry lake bed allegedly owned by plaintiff. Defendant had leased the land from a levee district which had been granted the land by the state. Plaintiff contended that the wells were not included in the lease but were on land excluded by a surveyor from the plat incorporated into the lease and since repossessed by the state. Plaintiff also argued that, since the lake was navigable upon the state's admission to the Union, the dry bed was sovereign property and not subject to ownership by the levee district. On rehearing, the court held that the surveyor's error in excluding the land in question did not prevent the parties to the lease, defendant and the levee district, from affirming their intention to include the property in the lease. The court also noted that the decree revesting the land in the state did not act retroactively so as to give the state a cause of action which had already accrued to the levee district. The court vacated its prior judgment and affirmed the judgment for defendant. (Liptak-Florida)
W71-02347

ARCHER V BOARD OF MISSISSIPPI LEVEE COMM'RS (RIPARIAN RIGHTS INCLUDE TAKING GRAVEL FROM RIVER).

130 So 55-56 (Miss 1930).

Descriptors: *Mississippi, *Eminent domain, *Riparian rights, *Boundaries (Property), Condemnation, Riparian land, Riparian waters, Judicial decisions, Legal aspects, Levees, Gravels, Sands, Ownership of beds, Beds, Navigable rivers, Navigable waters, Mississippi River, Flood control, Federal government, Governments, State governments, Water rights.

Defendant owned land abutting the Mississippi River. The chief value of defendant's property was the riparian rights to land in the river for procuring sand and gravel. Plaintiff board of levee commissioners instituted a proceeding to condemn defendant's property. The trial judge instructed the jury not to take into consideration any value of the gravel in the river in determining the value of defendant's condemned property. Defendant appealed the damages award of the trial court for insufficiency. The Supreme Court of Mississippi held that the instruction not to consider the value of gravel in the river channel was reversible error. The court stated that defendant's riparian rights included the right to use land to the center of the stream and to take sand and gravel for commercial purposes, and the taking of such right should have been considered in plaintiff's damages award. (Powell-Florida)
W71-02348

CALDWELL V GORE (DUTY OF LOWER ESTATE TO ACCEPT NATURAL DRAINAGE FROM UPPER ESTATE).
144 So 151-153 (Ct App La 1932).

Descriptors: *Louisiana, *Surface drainage, *Obstruction to flow, *Dams, Ditches, Watercourses (Legal), Arkansas, Surface waters, Surface runoff, Overflow, Remedies, Land tenure, Judicial decisions, Legal aspects, Drainage, Drains, Canals, Overlying proprietor, Relative rights, Adjudication procedure.

Plaintiff upper landowner sought to restrain defendant lower landowner from constructing a dam so as to interfere with the natural drainage of plaintiff's property. Defendant admitted the allegations but contended that: (1) plaintiff's property was located in Arkansas while defendant's was located in Louisiana; (2) defendant's estate owed plaintiff's no servitude of drainage of surface water; and (3) plaintiff constructed a ditch through his property and increased the burden of drainage upon defendant's estate. The trial court granted the injunction and the Court of Appeal of Louisiana affirmed. The court pointed out that prior cases had ruled that an estate located in Louisiana owes a servitude to drain an upper estate in Arkansas. The court stated that if plaintiff had made defendant's servitude more burdensome, defendant should have resorted to the courts and invoked the summary remedy by injunction. Defendant's construction of the dam constituted taking the law into his own hands, which action could not be condoned by the courts. (Duss-Florida)
W71-02349

LIPSCOMB V GALOURAKIS (STATE AND COUNTY JURISDICTION TO REGULATE THE TAKING OF SPONGES IN GULF WATERS).
133 So 104-107 (Fla 1931).

Descriptors: *Florida, *Local governments, *State jurisdicition, *Commercial fishing, State governments, Fishing, Fishing gear, Equipment, Legal aspects, Judicial decisions, Legislation, High water mark, Boundaries (Property), Beds, Beds under water, Oceans, Gulfs, Bays, Gulf of Mexico, Aquatic animals.

Defendant sponge fishermen sought habeas corpus from an indictment charging them with violating Florida statutes regulating sponge fishing. Defendants contended that the offenses alleged, since they took place in the Gulf of Mexico, were committed outside the jurisdiction of the county where the indictment was brought. The Supreme Court of Florida reversed a discharge of defendants. All the bottoms of gulfs and natural bays within the limits of the state passed to the state when Florida was admitted to the Union. Counties bordering on the Gulf of Mexico have jurisdiction over that area within the Gulf adjacent to the upland and out to the state boundary line. The jurisdiction is bounded by lines drawn at right angles to the high water mark at each county's upland boundary. States may prescribe means and methods by which products of gulf waters within state boundaries may be taken for private or commercial use. (Dye-Florida)
W71-02350

ATLANTIC COAST LINE RR V HENDRY (LIABILITY OF RAILROAD FOR FAILURE TO PROVIDE DRAINAGE UNDER TRACKS).
150 So 598-599 (Fla 1933).

Descriptors: *Florida, *Obstruction to flow, *Excessive precipitation, *Culverts, Surface drainage, Rainfall, Legal aspects, Judicial decisions, Damages, Railroads, Farms, Crops, Construction, Flood damage, Drainage, Surface waters, Natural flow, Rainfall intensity, Floods.
Identifiers: *Act of God.

Plaintiff farmer sued defendant railroad company for flood damages allegedly caused by defendant's failure to construct enough culverts when bulding a railroad bed. The bed bisected plaintiff's land. Defendant argued that the damage to plaintiff's crops was caused by heavy rains which were an act of God. The Supreme Court of Florida, in affirming a verdict for plaintiff, held that a defendant seeking to assert the defense of an act of God has the burden of showing that he did not also contribute to the damage. There was evidence that defendant knew it was not making sufficient provision for passage of water. Defendant had not proved that all damage was caused by an act of God. (Morris-Florida)
W71-02351

THE KARD (DAMAGES TO BARGE CAUSED BY RAILROAD'S DRAWBRIDGE OVER NAVIGABLE WATERS).

38 F2d 844-848 (ED Pa 1930).

Descriptors: *Pennsylvania, *Bridges, *Railroads, *Navigation, Ships, Admiralty, Damages, Legal aspects, Judicial decisions.

Plaintiff barge owner brought libel against defendant tug and her owners, who impleaded defendant railroad. The tug was towing plaintiff's barge upriver and signaled the railroad to open the draw-bridge for their passage. The railroad's agent opened the span only partially, and the barge's derrick collided with the drawbridge, causing severe injury. Through a later misunderstanding between plaintiff and defendant tug, the barge was left unattended and sank overnight. The court noted that the right of navigation is paramount to the railroad's right to maintain the bridge, and that the bridge must be operated so that navigation is not

unnecessarily impeded. Stating that the tug might proceed after having given the opening signal, and that raising the draw was an invitation for the tug to pass through, the court held that the railroad had failed to comply with regulations and was therefore liable for the earlier injury. The additional damages caused by leaving the barge unattended overnight should be apportioned between plaintiff and defendant tug. (Hart-Florida)
W71-02352

PAN-AMERICAN PETROLEUM AND TRANSP CO V GREAT LAKES DREDGE AND DOCK CO (DAMAGES FOR STRIKING OBSTRUCTION IN DREDGED CHANNEL).
27 F2d 442-443 (SD NY 1928).

Descriptors: *New York, *Navigable waters, *Admiralty, *Dredging, Damages, Channels, Navigation, Navigable rivers, Federal jurisdiction, Boats, Judicial decisions, Legal aspects, Rocks, Remedies, Adjudication procedure.

Plaintiff ship company brought libel action against defendant dredging company for damages which one of its ships had sustained in a collision with a submerged object. Libelant alleged that the dredging company, which was deepening the channel, had placed rocks in the channel and that libelant's vessel had struck the rock. The federal district court dismissed libelant's action. Libelant had the burden of proving that its damage was occasioned by striking the rock placed in the channel by the dredging company. Libelant had failed to establish this. Furthermore, the evidence showed that libelant was aware of the dredging and had been warned against piloting vessels too near the dredging operations. (Duss-Florida)
W71-02353

UNITED PAPERBOARD CO V IROQUOIS PULP AND PAPER CO (INTERPRETATION OF DEED WITH RESERVED WATER RIGHTS).
215 NYS 741-748 (1926).

Descriptors: *New York, *Water rights, *Dams, *Land tenure, Riparian rights, Ponds, Relative rights, Judicial decisions, Legal aspects, Preferences (Water rights), Riparian waters, Riparian land, Water utilization, Reasonable use, Adjudication procedure.
Identifiers: *Flashboards.

The lands of plaintiff and defendant, located on a river, originally formed a single tract. The parties' predecessor in title had obtained water from a pond above a dam located above the single tract. In obtaining the water the grantor had placed flashboards on top of the dam. Subsequently, the deed, which conveyed half of the single tract to plaintiff, granted plaintiff all water rights to the pond except rights to the water actually flowing over the crest of the dam. Defendant acquired the remainder of the tract, including the water rights reserved from plaintiff's deed. Plaintiff sought an injunction to enjoin defendant from withdrawing water from the pond. Defendant contended that the deed reservation permitted him to draw pond water whenever its level was higher than the crest of the dam, exclusive of flashboards. Plaintiff contended the water had to be actually flowing over the flashboards. The appellate court, in granting an injunction, held the grant permitted defendant to use only water flowing over the flashboards. The court stated that the water right, as primarily granted, would not be impaired by the exception in the grant further than necessary. (Powell-Florida)
W71-02354

PEOPLE V NEW YORK AND ONTARIO POWER CO (OWNERSHIP OF BEDS OF NAVIGABLE STREAMS).

219 App Div 114, 219 NYS 497-504 (1927).

Descriptors: *New York, *Ownership of beds, *Navigable waters, *Navigable rivers, Navigation, Channels, Beds, Dams, Boats, Islands, Shores, Riparian land, Riparian rights, Land tenure, Public rights, State jurisdiction, Water rights, Permits, Powerplants, Rivers, Streams, Judicial decisions, Legal aspects, Hydroelectric power, St. Lawrence River.

The people of New York brought action in ejectment to recover land in the bed of the St. Lawrence River. The land was claimed by defendant power company and defendant corporation. Defendant power company owned and operated a dam on the River. The trial court dismissed the complaint and the appellate court affirmed. The court stated that the St. Lawrence River was a navigable stream. Rights and title in the beds of navigable streams are controlled by the state law where the stream is located. Title to beds is in the state in trust for the people unless specifically granted to others. The state holds the right to control commerce and navigation, but it may grant, in the public interest, unconditional rights in shore waters or streams. All grants for private benefit are conditional ones and subject to the right of the state to improve the stream. One may not acquire rights which deprive the state of the power to improve navigation. Riparian owners on navigable streams possess the same rights as owners on private streams. Defendant power company was a riparian ownerbut not the owner of the bed where its dam was located. However, none of defendant's construction on the bed obstructed navigation. The court held, therefore, that the state would not be prejudiced by permitting defendant to continue its use until the state adopted a plan for developing the stream. (Duss-Florida)
W71-02355

VAN CORTLANDT V NEW YORK CENT RR (BRIDGE OBSTRUCTING NAVIGABLE STREAM NOT ENJOINED WHERE NO DAMAGE SHOWN).
238 App Div 132, 263 NYS 842-853 (1933).

Descriptors: *New York, *Bridges, *Navigable waters, *Navigation, Streams, Riparian rights, Relative rights, Public rights, Legal aspects, Remedies, Damages, Judicial decisions, Structures, Railroads.

Plaintiff upper riparian landowners sought an injunction to force defendant railroad company to remove a bridge extending across a stream. Plaintiffs contended that, although an accumulation of silt and debris rendered the stream navigable only to small craft, it was still navigable in fact. Plaintiffs therefore maintained that defendant could not erect an obstruction to navigation thereupon. Defendant contended that plaintiffs' had suffered no damage and that their rights had not been impaired. In addition, defendant contended that the stream was not navigable because only small craft could navigate the waters. The New York Supreme Court held that: (1) a stream which at one time has been navigable but because of accumulation of debris and silt is navigable only to small craft is navigable in fact; but (2) where damages are speculative, although the stream might in the future be made profitably navigable, riparian owners are entitled only to nominal damages. (Quesada-Florida)
W71-02356

PIGEON RIVER IMPROVEMENT, SLIDE AND BOOM CO V CHARLES W COX, LTD (USE AND CONTROL OF STREAMS WHICH FORM AN INTERNATIONAL BOUNDARY).
291 US 138, 54 S Ct 361-368 (1934).

Descriptors: *Minnesota, *Navigable waters, *Competing uses, *International waters, Rivers, Legislation, Federal government, State governments, Legal aspects, Judicial decisions, Political aspects, Industrial use, Structures, Dams, Lumbering, Access routes, Riparian rights, International law, Boundaries (Property), Treaties, Relative rights, Regulation.

Plaintiff Minnesota corporation brought an action against defendant Canadian corporation to collect tolls for the use by defendant of improvements maintained by plaintiff in the Pigeon River, a boundary stream between Minnesota and Canada. Plaintiff contended that it was authorized by Congress and the state of Minnesota to maintain such devices and to collect tolls for their use as an aid to commerce. Defendant contended that according to a treaty between the United States and Canada it had the right to the use of the river both in Canada and the United States. The Supreme Court held that congressional acquiescence in the action of the state of Minnesota in authorizing improvements on that part of the river within its jurisdiction constituted a practical construction of the treaty and that the state could authorize the creation of improvements in a navigable river to aid commerce if such improvements were not a violation of the treaty or in conflict with congressional legislation. The trial court's judgment for defendant was reversed. (Quesada-Florida)
W71-02357

WYOMING V COLORADO (ENFORCEMENT OF JUDICIAL DECISION SETTING OUT RELATIVE RIGHTS OF ADJOINING STATES TO QUANTITY OF WATER DIVERTED FROM NAVIGABLE RIVER).
286 US 494, 52 S Ct 621-627 (1932).

Descriptors: *Wyoming, *Colorado, *Diversion, *Relative rights, Diversion dams, Navigable waters, Alteration of flow, State governments, Riparian rights, Irrigation practices, Legal aspects, Judicial decisions, Beneficial use, Public benefits, Adjudication procedure.

Plaintiff state sought to enforce against defendant state an earlier court decree as to the relative rights to divert water from a navigable river which flowed through defendant state into plaintiff state. Plaintiff contended that defendant state was violating the provisions of the decree by diverting water in excess of its allotted amount. Plaintiff maintained that it should be permited to install measuring devices in the river within defendant state in order to insure compliance with the provisions of the decree. Defendant denied that it was diverting water in excess of its quota and refused to allow plaintiff to install the measuring devices. Additionally, defendant contended that if any additional water was being diverted, it was being done by private corporations acting without state authority, for which defendant state was not liable. Defendant further contended that the suit should be dismissed because it contained no specific allegations. The Supreme Court of the United States held that the allegations of plaintiff were sufficient to warrant a determination by the lower court and should not be dismissed. Defendant was required to answer plaintiff's bill. (Quesada-Florida)
W71-02358

UNITED STATES V HOLT STATE BANK (TITLE TO LAND UNDER NAVIGABLE WATER VESTS IN STATE ON ADMISSION TO UNION).
270 US 49, 46 S Ct 197-200 (1926).

Descriptors: *United States, *Lakes, *Navigable waters, *Ownership of beds, Minnesota, Lake beds, Land reclamation, Public lands, Federal reservations, Indian reservations, Boundaries (Property), Land tenure, Federal government, State governments, Navigation, Rivers, Legal aspects, Public rights, Legislation, Judicial decisions, Adjudication procedure.

Plaintiff United States brought suit against defendant bank to quiet title to land that once was a lake bed. Plaintiff argued that the lake was not navigable when Minnesota, defendant's grantor, was admitted to the Union and that the lake was part of an Indian reservation, to be disposed of as homestead property. Defendant argued that the lake was navigable in fact and title to the bed was therefore vested in the sovereignty of the state upon its admission to the Union. Affirming the dismissal of the

complaint, the Supreme Court held that the lake was navigable in fact, even though the lower courts erroneously applied local standards, since the same result would have been reached by applying the federal standard of 'susceptibility to navigation.' The court noted that the United States held submerged lands in trust for future states, and a disposal of such land could not be lightly inferred in the absence of legitimate public purpose or international obligation. (Liptak-Florida)
W71-02359

ARKANSAS POWER AND LIGHT CO V ORR (LIABILITY FOR FLOOD DAMAGE CAUSED BY NEGLIGENT FLOODGATE OPERATION).
298 SW 1029-1032 (Ark 1927).

Descriptors: *Arkansas, *Water injury, *Hydroelectric plants, *Floodgates, Streams, Overflow, Flood damage, Floods, Crop response, Dams, Reservoir operation, Lakes, Legal aspects, Natural flow doctrine, Rainfall, Cloudbursts, Riparian land, Riparian rights, Damages, Judicial decisions, Adjudication procedure.

Plaintiff landowner brought action against defendant power company to recover for flood damage to his corn crop caused by defendant's operation of floodgates at its hydroelectric plant. Plaintiff contended that defendant's employees were negligent in opening the floodgates so as to increase the water flow and cause an overflow of plaintiff's land. Defendant contended that the overflow was the result of heavy rainfall rather than negligence, that such overflow occurred both above and below the dam, and that defendant was not an insurer of the safety of riparian lands. The court noted that submission of the allegation and proof of negligence to the jury was proper and did not operate to make defendant an insurer. However, the court reversed the judgment for plaintiff and remanded the case for a new trial because of the improper admission of hearsay evidence concerning the conduct of defendant's employees in operating the floodgates. (Liptak-Florida)
W71-02360

RYAN V COMM'RS OF WATER DIST NO 1 (NOTICE REQUIRED FOR VALID ASSESSMENT BY WATER DISTRICT).
220 Ky 822, 295 SW 1023-1025 (1927).

Descriptors: *Kentucky, *Assessments, *Water districts, *Adjudication procedure, Remedies, Taxes, Government finance, Water supply, Governments, Local governments, Legislation, Administrative agencies, Administrative decisions, Legal aspects, Judicial decisions, Eminent domain.

Plaintiff landowner sued to declare invalid an assessment and proposed bond issue by defendant water district. Plaintiff contended that the assessment was void for lack of due process because the landowners did not receive notice of the proceedings other than by publication. Defendant argued that the statute creating the water district and authorizing the assessment only required notice by publication and that such notice was sufficient for assessments for public purposes. Affirming a judgment for defendant, the court held that personal notice was only required in actions between citizens, and notice by publication was sufficient for eminent domain or tax proceedings between a citizen and a governmental body. The court also noted that the landowners had waived their right to question the validity of the assessment since none of them appeared at, or objected to, the assessment proceedings or the final court hearing. Moreover, they had not prosecuted an appear from any of those proceedings. (Liptak-Florida)
W71-02361

PRUYN V NELSON BROS (BATTURE LAND SUBJECT TO PUBLIC SERVITUDE FOR USE IN CONSTRUCTING AND REPAIRING LEVEES).
180 La 760, 157 So 585-588 (1934).

Descriptors: *Louisiana, *Levees, *Public rights, *Repairing, Banks, Mississippi River, Navigable rivers, Rivers, Accretion (Legal aspects), Administrative agencies, Administrative decisions, Federal government, United States, State governments, Flood protection, Legal aspects, Judicial decisions, Reasonable use, Riparian land, Riparian rights, Excavation, Eminent domain, Easements, Construction, Supervisory control (Power).
Identifiers: *Servitudes.

Plaintiff riparian owner sued to enjoin defendant contractor from removing soil from batture land on the Mississippi River. The soil was to be used by the local levee district and the federal government to make levee repairs. Plaintiff sought to recover damages for soil already removed. Plaintiff contended that the removal of the soil was unnecessary and that part of the soil removed would be used outside of the levee district's territory by the federal government. Defendant contended that all batture land is subject to a public servitude for the building and repairing of levees, limited only by reasonable use, and that the intended use was necessary and reasonable. Since the levee had already been repaired, the court only considered plaintiff's damage claim. The court noted that the United States government was a proper party to exercise the public servitude, especially where its plans had been approved by the proper state and local agencies. Affirming a judgment for defendant, the court held that the evidence showed that the levee repairs were necessary to protect the public from flooding and that it was not unreasonable for the levee district to authorize defendant to use the most available and suitable soil. (Liptak-Florida)
W71-02362

HICKS V STATE EX REL LANDIS (RIGHT TO MAINTAIN DOCK ON STATE-OWNED LAKE BED SUBJECT TO PUBLIC TRUST).

156 So 603-605 (Fla 1934).

Descriptors: *Florida, *Lake beds, *Public lands, *Docks, State governments, Administrative agencies, Administrative decisions, Lakes, Beds, Navigable waters, Ownership of beds, Public rights, Legal aspects, Judicial decisions, Navigation, Access routes, Permits, Recreation.

Plaintiff state brought action to evict defendant from a portion of the bed of a navigable lake and to compel defendant to remove a wharf and two boathouses which he had erected. Plaintiff contended that land under navigable waters is held by the state in trust for the people, for their navigation and enjoyment, and that defendant was trespassing on such trust property. Defendant contended that the state board of trustees, which held title to all state sovereignty lands, had granted to the county the right to use the land for improvement of public access to the lake. The county had transferred that right to defendant. Reversing a judgment for plaintiff, the court held that the board of trustees could lawfully convey rights in sovereignty lands as long as the conveyance was in promotion of the public interest. (Liptak-Florida)
W71-02363

INLAND WATERWAYS CO V CITY OF LOUISVILLE (CITY'S POWER TO LEASE WATERFRONT FOR PRIVATE WHARF PURPOSES).
227 Ky 376, 13 SW2d 283-288 (1929).

Descriptors: *Kentucky, *Navigable rivers, *Docks, *Leases, Rivers, Ohio River, Inland waterways, Permits, Cities, Local governments, Legislation, Riparian land, Riparian rights, Riparian waters, Public rights, Transportation, Legal aspects, Judicial decisions.

Plaintiff city leased river front property to defendant corporation to develop a river terminal. Plaintiff then brought action to declare the lease invalid and to recover the property. Plaintiff contended that the grant of a franchise to operate a public wharf requires an advertisement and public sale and that the board of public works, which granted the lease, had no power to grant such a franchise. Defendant contended that the city could lease its property for wharf purposes just as any other riparian owner. Reversing a judgment for plaintiff, the court noted that a franchise was a grant of a right which could not be exercised without sovereign authority. However, the right to wharf and lease property was common to all riparian owners. The court also noted that whether the wharf was public or private did not depend on the ownership of the land on which the wharf was built, but the use to which the wharf was put. (Liptak-Florida)
W71-02364

ARKANSAS POWER AND LIGHT CO V BEAUCHAMP (NEGLIGENCE IN DAM OPERATION AS CAUSE OF FLOODING).
43 SW2d 234-237 (Ark 1931).

Descriptors: *Arkansas, *Adjudication procedure, *Dams, *Floods, Damages, Legal aspects, Streams, Judicial decisions, Precipitation excess, Electric power industry, Floodgates, Structures, Flood damage, Flow, Low water mark, Reservoir operation, Floodwater, Overflow, Rain, Rainwater.

Defendant power company operated a dam upstream from plaintiffs' property. During a period of heavy rainfall plaintiffs' lands were flooded and their crops destroyed. Palintiffs sought damages, contending that the damage resulted from negligent operation of defendant's dam. Defendant contended that the damage was caused by normal floodwaters and introduced evidence indicating a lack of negligence. Despite defendant's evidence, a jury found for plaintiffs. Defendant appealed on the grounds that plaintiffs had not proved their case. The Supreme Court of Arkansas affirmed. A verdict supported by some substantial testimony may not be set aside on appeal, even though apparently against a preponderance of the evidence. In the instant case the floodwaters were clear, indicating that they came from the reservoir. Moreover, the waters rose faster than in times before the construction of the dam. Such evidence was sufficient to support a jury's inference of negligence. (Dye-Florida)
W71-02365

MISSOURI PAC RR V BAKER (LIABILITY FOR FLOOD DAMAGE CAUSED BY CLOGGED CULVERT).
64 SW2d 321-322 (Ark 1933).

Descriptors: *Arkansas, *Floods, *Culverts, *Damages, Railroads, Crops, Crop production, Flood damage, Surface drainage, Legal aspects, Adjudication procedure, Judicial decisions, Water injury, Surface runoff, Obstruction to flow.

Plaintiff landowner sued defendant railroad for damages caused by crop flooding. Defendant's railroad culvert became clogged, causing water to back up and flood plaintiff's crops. On appeal, defendant contended that there was insufficient evidence to justify the jury verdict that the clogged culvert caused the damage and that the trial court erred in failing to instruct the jury that it was plaintiff's duty to minimize damages by clearing the culvert himself. The Supreme Court of Arkansas found ample evidence to justify the verdict. Noting that to minimize damages plaintiff would have had to trespass, the court held that under the circumstances plaintiff was not required to clear the culvert. The lower court's decision for plaintiff was affirmed. (Hart-Florida)
W71-02366

BOURLAND V CITY OF FORT SMITH (PROPRIETY OF CITY'S ACTION TO IMPROVE WATER SUPPLY).
78 SW2d 383-386 (Ark 1935).

Descriptors: *Arkansas, *Cities, *Contracts, *Reservoirs, Water works, Financing, Government finance, Interest, Administrative agencies, Water supply, Water rates, Dams, Domestic water, Water sources, Judicial decisions, Legal aspects, Supervisory control (Power), Water pollution.

Plaintiff municipal landowner sought to enjoin defendant city from building a reservoir and conveying such improvmenets to a waterworks district. Plaintiff alleged that the project was an abuse of discretion and that the contracts between the city, waterworks district, and the Public Works Administration were ultra vires. The court determined that the project was necessary because of pollution of the existing water supply, rejecting plaintiff's abuse-of-discretion argument. The court observed that a literal interpretation of the statute creating the waterworks district would justify plaintiff's latter assertion, but stated that the statute's purpose was to furnish the municipality with an adequate water supply. The statute should be liberally interpreted and applied to achieve that purpose. Holding that the project was valid, the court affirmed the lower court's decision for defendant. (Hart-Florida)
W71-02367

CASHION V MEREDITH (OWNERSHIP OF ACCRETED LAND).
64 SW2d 670-674 (Mo 1933).

Descriptors: *Missouri, *Accretion (Legal aspects), *Land tenure, *Real property, Legal aspects, Judicial decisions, Adjudication procedure.

In a suit for ejectment and partition, involving adverse possession, the Supreme Court of Missouri stated that accreted land becomes the property of the owner of the tract to which it attached. (Hart-Florida)
W71-02368

ZOOK V CITY OF LOUISIANA (BLOCKAGE OF DRAIN CAUSED BY CITY'S PAVING OF STREET).
12 SW2d 518-520 (Mo 1929).

Descriptors: *Missouri, *Surface runoff, *Paving, *Diversion, Road construction, Surface waters, Cities, Drains, Alteration of flow, Flood damage, Legal aspects, Damages, Legislation, Channels, Adjudication procedure, Local governments, Ditches, Erosion, Judicial decisions, Overflow, Natural flow, Obstruction to flow.

In an action for damages, plaintiff alleged that when defendant city paved a street near her property, it negligently filled in the gutter which carried surface water therefrom. This caused surface runoff to be diverted onto plaintiff's property. In reversing a lower court decision for the city, the appellate court held that plaintiff had stated a cause of action. Municipalities are liable where, in the construction of streets, surface runoff is forced out of its natural drainage and onto adjacent landowners' property. While the city was entitled to cast off surface waters as a consequence of paving and grading a street, it was not entitled to change the natural flow of surface water and cast it onto plaintiff's property in an increased volume. (Caldwell-Florida)
W71-02369

KENTUCKY ELEC DEV CO'S RECEIVER V WELLS (LIABILITY FOR DAMAGE CAUSED BY DAM MAINTAINED AT UNAUTHORIZED HEIGHT DURING UNPRECEDENTED FLOOD).
256 Ky 203, 75 SW2d 1088-1095 (1934).

Descriptors: *Kentucky, *Dams, *Historic flood, *Public utilities, Water injury, Floods, Backwater, Maximum probable flood, Streams, Hydroelectric plants, Concrete dams, Damages, Legal aspects, Judicial decisions, Prescriptive rights, Eminent domain, Obstruction to flow.

Plaintiff landowner brought action against defendant electric company to recover for flood damages to his land, and also sought to restrain defendant from maintaining the dam at a height higher than that maintained by defendant's predecessor. Plaintiff contended that the new height of the dam interfered with the drainage of his land and that the backwater flooded his crops. Defendant contended that the damage was caused by an unprecedented flood and that the dam could be maintained at any height since defendant was a public service corporation which had the power to obtain the right to dam to the new height by eminent domain. The court noted that, it the extra height of the dam contributed to plaintiff's damage, defendant could still be liable for the results of an unprecedented flood. The court agreed that defendant should not have to remove a permanent portion of the dam, but held that plaintiff should have another cause of action to recover for the permanent damages caused thereby. The court affirmed the damage award and that part of the lower order requiring defendant to remove temporary portions of the dam. However, the court reversed the part of the order requiring defendant to lower the permanent dam structure. (Liptak-Florida)
W71-02370

TOLER V BEAR CREEK DRAINAGE DIST (AUTHORITY OF DRAINAGE DISTRICT TO DIVERT WATER FROM WATERSHED).
106 So 88-94 (Miss 1925).

Descriptors: *Mississippi, *Drainage districts, *Flood control, *Watersheds (Divides), Alteration of flow, Rivers, Drainage practices, Levees, Administrative agencies, Floods, Surface waters, Governments, Legal aspects, Water levels, Diversion, Ditches, Artificial watercourses, Public rights, Benefits, State jurisdiction, Supervisory control (Power), Relative rights, Judicial decisions, Legislation.

Plaintiffs challenged the authority of defendant drainage district to implement a flood control program. The objectionable part of the plan was the digging of three ditches to carry floodwaters out of the district over a divide and into the Sunflower River. Plaintiffs argued that drainage districts were prohibited by statute from diverting water from one watershed to another, and that this would be violated by digging the ditches across a divide. Rejecting the contention, the court held that since the floodwaters would eventually reach the river anyway, regardless of the ditches, the effect of the plan was not to unlawfully transfer water between watersheds. Moreover, the court held that the district was properly established under the police power of the state, the purpose of such districts being to promote the public welfare. The private drainage rights of plaintiffs, landowners within the district, were supplanted by the rights conferred on the district by statute. (Caldwell-Florida)
W71-02371

WYNN V WILSON (SEEPAGE FROM IMPROPERLY CAPPED OIL WELL ALLEGED TO HAVE DAMAGED SPRING AND LAND).
252 Ky 352, 67 SW2d 483 (1934).

Descriptors: *Kentucky, *Oil wells, *Seepage, *Springs, Water supply, Damages, Oil, Well casings, Mixing, Water pollution sources, Adjudication procedure, Legal aspects, Land use, Judicial decisions.

In an action for damages, plaintiff claimed that defendant had improperly plugged an oil well after removal of the casing, thereby causing oil to seep into a spring on plaintiff's property. The court found that although oil was found in the spring some time after the well was improperly plugged, there was no evidence of any seepage from the well into the spring, which was several hundred feet away. Moreover, there was evidence that one of the springs on plaintiff's land had oil in it before defendant's well was drilled, and that no oil had been found in the spring in question until it was cleaned out. Holding that it was probable that the oil had come from a source other than defendant's well, the court reversed a lower court decision for plaintiff. (Caldwell-Florida)
W71-02372

DAWSON V JOHNSON (DISPUTE OVER OWNERSHIP OF STREAM BED).
249 Ky 839, 61 SW2d 878-879 (1933).

Descriptors: *Kentucky, *Boundary disputes, *Boundaries (Property), *Ownership of beds, Meanders, Streams, Land tenure, Legal aspects, Channels, Streambeds, Remedies, Thalweg, Judicial decisions.

Plaintiff sought to assert ownership in the entire bed of a stream forming part of the boundary between his and defendant's property. Defendant claimed that his property extended to the middle of the stream's channel. The court conceded that if each party's deed had conveyed land described as running with the meanders of the stream, each would have acquired title to the middle of the stream. However, the court found that plaintiff's deed, which was prior in time, had conveyed to him ownership of the entire streambed. Therefore plaintiff was entitled to a settlement of the boundary line in his favor. (Caldwell-Florida)
W71-02373

FAIRCHILD V MAYO (DISPUTE AS TO WHETHER A SHIFT IN A STREAM'S CHANNEL RESULTED IN ACCRETION).
232 Ky 778, 24 SW2d 599-600 (1930).

Descriptors: *Kentucky, *Boundary disputes, *Boundaries (Property), *Accretion (Legal aspects), Land tenure, Legal aspects, Streams, Surveys, Judicial decisions, Bank erosion, Meanders, Channels, Channel flow, Thalweg.

A creek ran between plaintiff's and defendant's property, plaintiff's land lying on the south and defendant's on the north. The creek's channel had gradually shifted toward the south so that a 1 1/4 acre tract, the subject of the dispute, lay between the original and the new channel. The crucial question was whether the boundary between plaintiff and defendant was the center of the creek's channel or its northern bank. The court stated that if the center of the channel were the boundary, the disputed tract would be an accretion to defendant's land. If, on the other hand, there were a definite boundary on the north bank, it would not be affected by the channel's shift and the property would belong to the plaintiff. The court held that the original deed set the boundary as the north bank of the stream. Therefore, the disputed tract had not accreted and belonged to the plaintiff. (Caldwell-Florida)
W71-02374

KANSAS CITY FIBRE BOX CO V F BURKART MFG CO (OWNERSHIP OF LAND BY VIRTUE OF ACCRETION).
44 SW2d 325-330 (Ark 1931).

Descriptors: *Arkansas, *Accretion (Legal aspects), *Land tenure, *Lumber, Riparian land, Boundaries (Property), Boundary disputes, Surveys, Legal aspects, Rivers, Damages, Lumbering, Forests, Channels, Judicial decisions.

Plaintiff sought replevin of a quantity of lumber which it claimed had been cut from land belonging to it. The basis of plaintiff's claim was that the tract in question had accreted to other riparian land owned by plaintiff. Conflicting evidence was presented at trial, but the jury found for the plaintiff, rejecting defendant's contention that it held the tract by adverse possession. The appellate court held that the trial judge's instructions as to accretion and other issues presented in the case were correct. Decision for the plaintiff was affirmed. (Caldwell-Florida)
W71-02375

DALY V STATE (NO OBLIGATION RESTS ON STATE TO PROTECT LANDS THAT WOULD BE FLOODED EVEN IN ABSENCE OF STATE-CONSTRUCTED CANAL).
132 Misc Rep 92, 228 NYS 738-41 (1928).

Descriptors: *New York, *Overflow, *Discharge (Water), *Damages, Crop response, Surface waters, Canals, Channel improvement, Excavation, Canal construction, Muck soils, Embankments, Swamps, Floodwater, Flooding, Impounded waters, Landfills, Culverts, Judicial decisions, Legal aspects, Channel morphology.

Plaintiff landowner brought action against defendant state to recover damages for injury to his crops allegedly caused by the overlow of a canal constructed by defendant. The court stated that a landowner can do anything to prevent surface water from coming onto his land from adjoining lands, but he cannot collect it and discharge it in bulk on his neighbor's lands. The court found that the bulk of the water causing plaintiff's damage came from a brook initially and not the canal as charged by plaintiff. The flooding would have occurred even without the construction of the new canal. Defendant had no obligation to protect land which would have been flooded to the same extent if the canal had not been constructed. The claim of plaintiff was dismissed. (Price-Florida)
W71-02376

CITY OF NEW YORK V DYCKMAN MKT TERMINAL CORP (LANDS BETWEEN HIGH AND LOW WATER MARKS ARE CITY'S IN FEE AS PUBLIC LANDS).
130 Misc Rep 103, 224 NYS 207-209 (1927).

Descriptors: *New York, *High water mark, *Public lands, *Boundary disputes, Ownership of beds, Grants, Land tenure, Low water mark, Boundaries (Property), Judicial decisions, Legal aspects, Maps, Real property.

Plaintiff city sought to eject defendant corporation from certain lands, and contended that it owned in fee all lands lying between the high and low water marks on Manhattan Island. Defendant contended the lands in question were granted to the town of New Harlem, and plaintiff never became seized thereof. The Court of Appeal of New York had previously held that the lands between high and low water marks were not conveyed to the inhabitants of New Harlem under a certain grant, but to the city of New York under a specific charter. The issue here was whether the lands described in the complaint were located between the high and low water marks of the Harlem River. The court found that the lands so described laid inshore of the high water mark and therefore held the defendants to be owners in fee simple of the land. A verdict was directed in favor of defendants. (Price-Florida)
W71-02377

DAVISON V CITY OF ANN ARBOR (FAILURE OF PROOF THAT LOWERING OF WATER TABLE WAS DUE TO OTHER THAN NATURAL CAUSES).
237 Mich 453, 212 NE 81-83 (1927).

Descriptors: *Michigan, *Water wells, *Muck soils, *Water table, Pumping, Cities, Wells, Cultivated lands, Damages, Diversion losses, Water demand, Pumping plants, Crop response, Gravel, Percolation, Water supply, Water shortage, Water users, Legal aspects, Judicial decisions.

Plaintiff landowners sought to recover damages and to enjoin defendant city from using its water pumps. Plaintiffs contended that defendant's actions had reduced the water table on their land to the extent of making said land worthless for agricultural purposes. Defendant denied that its pumps had caused any injury to plaintiffs' property. Defendant proved to the satisfaction of the trial court, by expert testimony, that its taking of water at a depth of forty feet below the surface had no material effect on the water table on which plaintiffs relied for their water supply. The court concluded that plaintiffs had sustained no damage by the operation of defendant's pumping station and that the rescission of the flowing wells was not satisfactorily shown to have happened from other than natural causes. The judgment for defendant was affirmed. (Price-Florida)
W71-02378

ANDES V ANDES (WATER RIGHTS SUBJECT TO LEASEHOLD).
173 A 452-458 (Pa 1934).

Descriptors: *Pennsylvania, *Water rights, *Land tenure, *Water supply, Judicial decisions, Legal aspects, Adjudication procedure, Relative rights, Supply, Conjunctive use, Pipelines, Water utilization, Water sources, Use rates, Appropriations, Irrigated land, Irrigation, Damages, Greenhouses.

Plaintiff's grantor owned five coterminous lots served by springwater piped from one of them. Defendant was granted a long-term lease allowing him to use as much water from the spring as was necessary to supply his bottling plant which served a nearby city. Plaintiff was granted adjoining property with rights to the use of water passing through an existing pipe for the use of his two greenhouses and one field. Plaintiff constructed additional greenhouses and expanded his fields. Defendant began to sell water to cities other than the original one. Plaintiff brought an action for damages to his crops caused by defendant's use of all the water of the spring. Defendant answered that plaintiff's water rights were subject to his leasehold. A trial court verdict for plaintiff was reversed by the Superior Court of Pennsylvania. Plaintiff's damages should have been limited to the field and greenhouses existing at the time of his grant. Defendant was liable only to the extent that he used water from the spring for sale to towns other than the one specified in his lease. (Dye-Florida)
W71-02379

HAYS V HOFFMAN (OBSTRUCTION OF DRAINAGE DITCH ALLEGED TO HAVE CAUSED OVERFLOW).
160 SE 852-854 (SC 1931).

Descriptors: *South Carolina, *Obstruction to flow, *Ditches, *Prescriptive rights, Relative rights, Backwater, Legal aspects, Damages, Adjudication procedure, Contracts, Drainage, Overflow, Drainage practices, Drainage water, Surface waters, Surface runoff, Judicial decisions.
Identifiers: Injunction (Mandatory).

Plaintiff sought to enjoin defendant from obstructing a drainage ditch carrying surface water from plaintiff's land. The obstruction caused water to back up and overflow plaintiff's property. Plaintiff claimed a prescriptive right to have water drain from his property through the ditch onto defendant's land. Defendant denied this right, contending that the ditch was dug pursuant to a contract between himself and plaintiff. Plaintiff was alleged to have agreed to dig the ditch through defendant's land so that no water was cast thereon. However, plaintiff only dug some distance onto defendant's property and stopped. When large quantities of water overflowed defendant's land as a result, he obstructed the ditch. The court agreed with defendant, holding that no prescriptive right had been established, and allowed a counterclaim by defendant for damage to his property. (Caldwell-Florida)
W71-02380

TAYLOR V LEXINGTON WATER POWER CO (NEGLIGENT RELEASE OF FLOODWATERS FROM DAM).

163 SE 137-142 (SC 1932).

Descriptors: *South Carolina, *Dams, *Flood damage, *Impounded waters, Floods, Flow control, Public utilities, Relative rights, Riparian land, Damages, Floodgates, Pondage, Backwater, Legal aspects, Excessive precipitation, Dam construction, Adjudication procedure, Compensation, Rivers, Permits, Legislation.

Pursuant to legislative authority, defendant power company constructed a dam across a river. Before the dam was completed, heavy rainfall caused waters to back up behind the dam to a dangerous extent, and defendant opened the floodgates, damaging plaintiff's property. The court held that while the defendant had the right to build the dam, it had to pay for any damage proximately caused to surrounding landowners. This was so even though no negligence by defendant was shown. The court reasoned that because the dam was built under state authority for the public good, any damage caused by the dam was a 'taking' of private property for which compensation must be made. A lower court decision for defendant was reversed. (Caldwell-Florida)
W71-02381

FAIREY V SOUTHERN RY (RAILROAD EMBANKMENT ALLEGED TO HAVE DAMMED SURFACE RUNOFF).
160 SE 274-275 (SC 1931).

Descriptors: *South Carolina, *Embankments, *Repulsion (Legal aspects), *Riddance (Legal aspects), Railroads, Flood damage, Obstruction to flow, Floods, Ditches, Drainage, Surface runoff, Legal aspects, Surface waters, Flood waters, Drainage water, Backwater, Overflow.

In an action for damages, plaintiff claimed than an embankment of defendant railroad had the effect of damming surface runoff during periods of heavy rainfall. This caused water to back up and overflow plaintiff's property. The court dismissed the complaint, holding that the 'common enemy rule' applied. Under this rule, the railroad had the right to protect its right-of-way from surface runoff by any means possible, and any damage to the plaintiff caused thereby was not actionable. The defendant, in dealing with surface water on its own land, was not required to exercise even reasonable care to protect plaintiff from injury. (Caldwell-Florida)
W71-02382

BYRD V PENNSYLVANIA RR (OVERFLOW DAMAGE CAUSED BY PLUGGED RAILROAD CULVERT AFTER HEAVY RAINFALL).
145 SE 722-725 (Va 1928).

Descriptors: *Virginia, *Obstruction to flow, *Excessive precipitation, *Culverts, Surface runoff, Flood damage, Railroads, Embankments, Floods, Structures, Overflow, Natural flow, Adjudication procedure, Legal aspects, Judicial decisions, Overflow, Construction materials.

In an action for damages, plaintiff alleged that during a period of heavy rainfall, defendant railroad had negligently allowed a culvert under its embankment to become plugged by loose cross-ties and other construction material. This caused runoff to back up and overflow plaintiff's property. Defendant contended that it should not be held liable for damage caused by rainfall which was so heavy as not to be reasonably anticipated. The court held that there was sufficient evidence to justify submission of the case to a jury. A verdict for the plaintiff was upheld. (Caldwell-Florida)
W71-02383

BOSWORTH V NELSON (DISPUTE OVER EXISTENCE OF FISHING RIGHTS ALLEGEDLY RETAINED BY GRANTOR).
152 SE 575-581 (Ga 1930).

Descriptors: *Georgia, *Relative rights, *Easements, *Fishing, Water rights, Prescriptive rights, Water utilization, Recreation, Land tenure, Remedies, Adjudication procedure, Boating, Legal

aspects, Judicial decisions, Riparian land, Rivers, Streams, Ponds, Overflow, Public rights.
Identifiers: *Profits (A prendre).

Plaintiff was the original owner of land comprising defendant's tract and the surrounding territory. When plaintiff disposed of his property to defendant's predecessor in title and others, he reserved boating and fishing rights in the streams flowing through the properties. When defendant constructed a recreational facility along one of the streams, plaintiff sought to enjoin defendant from interfering with his retained rights. Defendant contended that plaintiff's 'rights' were void because they constituted an easement, which must be appurtenant to an estate in land. As plaintiff had retained no land, defendant argued, such easement could not exist. The court rejected this contention, holding that plaintiff's rights were profits a prendre, an estate in land which can exist by itself. The court further held that the public could not acquire such rights by prescription. The fact that plaintiff had allowed the public to use the stream for many years did not deprive him of his profit nor vest any rights in defendant. Plaintiff was held entitled to an injunction. (Caldwell-Florida)
W71-02384

HUGGINS V ATLANTIC COAST LINE RR (RAILROAD FILL ALLEGED TO HAVE CAUSED FLOODWATER DAMAGE).

155 SE 839-841 (SC 1930).

Descriptors: *South Carolina, *Railroads, *Obstruction to flow, *Floodwaters, Floods, Rivers, Flood damage, Culverts, Embankments, Backwater, Damages, Overflow, Adjudication procedure, Roads, Landfills, Alteration of flow, Excessive precipitation, Legal aspects, Structures, Judicial decisions.

In an action for damages, plaintiff alleged that during a period of high water, defendants' railroad bed had obstructed the flow of floodwaters. Such obstruction allegedly caused flood damage to plaintiff's property. Conflicting evidence had been presented at trial, some to the effect that a highway parallel to the railroad had obstructed the floodwaters. The court held that enough evidence favoring plaintiff had been presented to justify submitting the case to a jury. Since the jury had found for the plaintiff, the court declined to disturb the verdict, rejecting defendants' contention that it was entitled to a directed verdict. (Caldwell-Florida)
W71-02385

LAUMA V BUNKER HILL AND SULLIVAN MINING AND CONCENTRATING CO (EASEMENT TO DUMP WASTES).
41 F2d 358-361 (9th Cir 1930).

Descriptors: *Idaho, *Water pollution, *Riparian rights, *Easements, Legal aspects, Judicial decisions, Water pollution sources, Water pollution effects, Riparian land, Mining, Damages, Contracts, Competing uses, Wastes, Industrial wastes, Real property, Waste disposal, Mine wastes, Waste dumps.

Defendant mining company deposited wastes and debris in a stream which ran through plaintiff's property. The stream deposited the wastes on plaintiff's land, causing damage to his realty and livestock. Plaintiff sought damages under his right as a riparian owner to receive the waters of the stream in an unpolluted state. Defendant introduced an agreement between itself and plaintiff's grantor, in which plaintiff's grantor conveyed to defendant the right to dump waste and tailings into the stream. The Ninth Circuit Court of Appeals affirmed a judgment for defendant. An agreement for consideration in which a downstream riparian owner conveys the right to pollute a stream to an upstream owner creates an easement binding on the downstream owner's successors in title. (Dye-Florida)
W71-02386

LEITCH V CITY OF CHICAGO (FEDERAL JURISDICTION OF CASES INVOLVING NAVIGABLE STREAMS).
41 F2d 728-732 (7th Cir 1930).

Descriptors: *Illinois, *Federal jurisdiction, *Adjudication procedure, *State governments, United States, Jurisdiction, Judicial decisions, Legal aspects, Navigable waters, Rivers, Streams, Navigation, Damages, Mississippi River, State jurisdiction, Riparian land, Governments.

Plaintiff sought to restrain defendant city from filling in a navigable stream which passed through his land. Plaintiff claimed that the federal courts had jurisdiction, since the stream was a navigable waterway governed by federal law under the Ordinance of 1787. The Seventh Circuit Court of Appeals affirmed dismissal of the complaint. The ordinance of 1787 remains in effect only insofar as not rejected by a state. The United States relinquished control of the rivers of Illinois by legislative act. The State of Illinois assumed control of navigable rivers of the state by statute. Therefore, jurisdiction over such watercourses remains in the state until affirmatively assumed by the United States. (Dye-Florida)
W71-02387

CLARION RIVER POWER CO V SMITH (POWERS OF THE FEDERAL POWER COMMISSION).
59 F2d 861-864 (DC Cir 1932).

Descriptors: *Federal Power Act, *Electric power, *Federal government, *Administration, Federal project policy, Projects, Federal jurisdiction, Hydroelectric plants, Hydroelectric project licensing, Legislation, Legal aspects, Judicial decisions, Jurisdiction, Governments, Administrative agencies, United States, Water resources development, Electric power industry, Public utilities, District of Columbia, Regulation, Supervisory control (Power).

Plaintiff power company was a licensee under the Federal Water Power Act. Plaintiff submitted to the Federal Power Commission, as required by the Act, an estimate of its investment in the licensed project. The commission investigated and determined that plaintiff's estimate was too high. Plaintiff sought in this action a determination that the Commission was without jurisdiction to make any adjudication or order with reference to the cost of the project. The Court of Appeals of the District of Columbia affirmed the trial court's dismissal of the complaint. The Act gives the Commission the authority to investigate investments of licensees in order to determine an equitable return should a project be taken over by the government in wartime as provided by the Act. Specific provisions of the Act require one who accepts a license to submit to governmental audit and investigation. (Dye-Florida)
W71-02388

WASHBURN V CAMPBELL (PAROL PERMISSION AS MERE LICENSE TO MAINTAIN DAM).
267 Mass 285, 166 NE 861-862 (1929).

Descriptors: *Massachusetts, *Dams, *Ponds, *Permits, Ice, Streams, Boundaries (Property), Damsites, Concrete dams, Impoundments, Water storage, Land tenure, Remedies, Judicial decisions, Legal aspects, Relative rights.

Plaintiff sought to enjoin defendant from destroying a dam which had been erected by plaintiff's predecessor with oral permission from defendant's predecessor. The dam, situated in a stream which formed the boundary between the property of the two parties, had created a pond used by plaintiff in the ice business. Defendant argued that plaintiff had acquired no right to maintain the dam through the earlier agreement with defendant's predecessor. The Supreme Judicial Court of Massachusetts, affirming the trial court's decision for defendant, ruled that the parol permission given by defendant's predecessor was merely a license. Such a license was revocable at will both by defendant's predecessor and those who took title under her. The suit was dismissed. (Barker-Florida)
W71-02389

HUNTER V CLEVELAND, C C AND ST L RY (COLLECTION AND DISCHARGE OF WATER IN VOLUME PROHIBITED).
176 NE 710-712 (Ind 1931).

Descriptors: *Indiana, *Railroads, *Drainage systems, *Discharge (Water), Surface waters, Drainage, Drainage water, Ditches, Tiles, Sewers, Drains, Waste water, Septic tanks, Wells, Domestic wastes, Right-of-way, Volume, Relative rights, Remedies, Judicial decisions, Legal aspects, Natural flow, Bridges.

Plaintiff railway sought to enjoin defendants from collecting surface water, waste water, and water from septic tanks and discharging the same through a sewer drain onto plaintiff's right-of-way. Defendants, in developing a subdivision, had constructed a sewer system which emptied into a ditch constructed by plaintiff for the purpose of carrying off normal surface drainage. Plaintiff argued that defendants had so increased the volume and force of discharge as to threaten the safety of plaintiff's track ballast and bridges. Defendant argued that the water was following its natural drainage course, in no way threatened plaintiff's operations, and that plaintiff was bound to provide for drainage of the water since plaintiff's right-of-way interfered with the natural drainage. The Appellate Court of Indiana, affirming a lower decision for plaintiff, ruled that defendants had no right to collect the water and discharge it in volume onto plaintiff's property. (Barker-Florida)
W71-02390

CASHIN V CITY OF NEW ROCHELLE (DAMAGES FROM OVERFLOW OF STREAM).
256 NY 190, 176 NE 138-140 (1931).

Descriptors: *New York, *Overflow, *Flood damage, *Damages, Cities, Streams, Discharge (Water), Flooding, Riparian land, Excess precipitation, Local governments, Sewers, Drainage systems, Drainage practices, Drains, Volume, Right-of-way, Remedies, Judicial decisions, Legal aspects, Impounded waters, Land tenure, Rent.

Plaintiff landowner sought to recover damages to her property. The damages were allegedly caused by defendant city's collection and subsequent discharge of water into a stream flowing through plaintiff's property. It was argued that such discharge caused the stream to overflow and flood plaintiff's lands. Plaintiff further sought removal of an earth mound left by the city when it constructed a sewer through plaintiff's property. The trial court gave judgment for plaintiff, and defendant appealed on the measure of damages. The New York Court of Appeals, reversing the lower decision, ruled that damages for the overflow of land must be based on the difference between the rental value of such land without the overflow and the rental value with the overflow. The court further ruled that the leaving of the mound was merely a breach of condition of the right-of-way granted to defendant by plaintiff's predecessor. Such condition was for the benefit of the grantor only and gave plaintiff no claim against defendant. A new trial was ordered. (Barker-Florida)
W71-02391

BEAN V CENTRAL MAINE POWER CO (APPROPRIATION OF WATER CURRENT).
173 A 498-516 (Me 1934).

Descriptors: *Maine, *Obstruction to flow, *Prior appropriation, *Currents (Water), Riparian rights, Relative rights, Riparian land, Massachusetts, Dams, Judicial decisions, Legal aspects, Adjudica-

tion procedure, Streams, Alteration of flow, Flow, Mill dams, Structures, Mills, Competing uses, Riparian waters, Water utilization, Upstream, Downstream, Flow rates, Channel flow.

Defendant power company erected a dam downstream from plaintiffs' property, thereby decreasing the force of the current in a stream flowing through plaintiffs' land. No water-powered mills had ever been built on plaintiffs' land, but plaintiffs sought damages for the potential loss of water power resulting from the decreased current of the stream. Plaintiffs' claimed that the current was a valuable incorporeal hereditament incident to their property. The Supreme Judicial Court of Maine followed the law of the Massachusetts Colony, presumed to have been accepted by Maine, in finding for defendant. Current, as a potential source of water power, becomes property requiring compensation by a downstream taker only when it has been appropriated by the upstream owner. All riparian owners may use the current, but until some steps are taken to use it, no property interest vests. Defendant was not liable for appropriation of the current. (Dye-Florida)
W71-02392

BOSWORTH V NELSON (DISPUTE OVER BOATING RIGHTS).
158 SE 306-308 (Ga 1931).

Descriptors: *Georgia, *Non-navigable waters, *Boating, *Public rights, Relative rights, Easements, Recreation, Remedies, Adjudication procedure, Legal aspects, Judicial decisions, Ponds, Streams, Land tenure, Structures, Transportation, Fishing, Water rights.

Plaintiff, the original owner of the land of which defendant's tract was a part, had retained boating and fishing rights in the waters on the property when he sold it to defendant's predecessor in title and others. A previous case concerning the same parties had decided that the retention of fishing rights was effective and that a temporary injunction should be granted restraining defendant from interfering with plaintiff's reserved rights. The trial court later made the injunction permanent, and on appeal defendant argued that boating rights stood upon a different footing than fishing rights. Defendant contended that the public had a legal interest in boating upon the waters concerned, either for recreation or transportation purposes. The court rejected this contention, holding that since the case concerned an artificial pond, which was not a navigable body of water, the pond could not be subjected to any public use except by plaintiff's consent. (Caldwell-Florida)
W71-02393

BALDWIN V NEAL (LIABILITY FOR OBSTRUCTION OF STREAM FLOW BY INADEQUATE PASSAGEWAYS UNDER RAILROAD BRIDGE).
80 SW2d 648-650 (Ark 1935).

Descriptors: *Arkansas, *Flooding, *Excessive precipitation., *Obstruction to flow, Damages, Flood damage, Floodwater, Floods, Rain, Rain water, Streamflow, Streams, Rainfall, Railroads, Judicial decisions, Barriers, Flow, Bridges.

In an action to recover damages, plaintiff contended that defendant railroad, in building railroad trestles across a stream, had negligently obstructed the flow of waters of such stream during periods of excessive rainfall. Plaintiff contended that such obstruction caused water to accumulate behind the railroad embankment which resulted in plaintiff's farm land being flooded. Defendant contended that its duty to provide adequate passageways for the waters of the creek did not extend to waters flowing from excessive rainfall. The court held that it was the duty of the railroad company to provide adequate passageways as would permit the flow of the stream's water, even in periods of excessive rainfall. Defendant was thus liable for the flooding damages, and the trial court's judgment for plaintiff was affirmed. (Snow-Florida)
W71-02394

LEISL V CITY OF NEWPORT (LIABILITY FOR OVERFLOW RESULTING FROM INADEQUACY OF CULVERT).
258 Ky 506, 80 SW2d 556-557 (1935).

Descriptors: *Kentucky, *Flooding, *Excessive precipitation, *Obstruction to flow, Damages, Flood damage, Floodwater, Floods, Rain, Rain water, Streamflow, Streams, Rainfall, Judicial decisions, Barriers, Flow, Culverts, Conduits, Overflow.

In an action for damages, plaintiff contended that defendant municipality negligently constructed and maintained a culvert in a creek. Plaintiff contended that the culvert was inadequate to carry off the waters of the creek in heavy rains, and that such culvert caused waters to back up upon his property, thereby flooding and damaging it. Defendant contended that its duty in maintaining the culvert was to allow for carry off of water during ordinary rains, but not during heavy rains. The court held that one constructing and maintaining a culvert in a creek not adequate to carry off the water during ordinary rains is liable in damages caused by any overflow. However, the court held that there was no liability for such overflow resulting from extraordinary or heavy rains. The court affirmed the trial court's granting of defendant's demurrer since plaintiff's complaint alleged that the overflow resulted from heavy rains. (Snow-Florida)
W71-02395

FORKNER V CHESAPEAKE AND O RY (RESTORATION OF NATURAL DRAINAGE COURSE BY CULVERT).
247 Ky 550, 57 SW2d 489-490 (1933).

Descriptors: *Kentucky, *Watersheds (Basins), *Surface drainage, *Culverts, Drainage, Surface waters, Drainage engineering, Drainage water, Surface runoff, Drainage systems, Outlets, Drains, Conduits, Judicial decisions, Flow, Natural flow, Obstruction to flow, Barriers, Railroads.

Plaintiff sought an injunction to require defendant railroad company to stop up a culvert which passed under a railroad bed and discharged drainage water upon plaintiff's property. Plaintiff contended that when the railroad was first constructed there was no culvert, but instead the embankment retained the water on the high side of the track. Plaintiff sought to force defendant to restore this condition. Defendant contended that the natural watershed of the area was such that the drainage water flowed naturally across plaintiff's property. Defendant contended that the culvert merely restored the natural drainage course which the construction of the railroad tract had altered. The court held that defendant had acted correctly in restoring the natural condition by opening up the drain under its track and in restoring the flow as it would have existed if it had never been interfered with initially. The trial court's refusal of an injunction was affirmed. (Snow-Florida)
W71-02396

REUGSEGGER V CHIGAGO GREAT WESTERN RR (LIABILITY FOR FLOODING CAUSED BY OBSTRUCTION OF A STREAM).
29 SW2d 221-223 (Mo 1930).

Descriptors: *Missouri, *Obstruction to flow, *Flooding, *Excessive precipitation, Streams, Streamflow, Flow, Floods, Floodwater, Damages, Flood damage, Backwater, Overflow, Rain, Rain water, Judicial decisions, Railroads, Rainfall, Barriers, Legal aspects, Riprap.

In an action for damages, plaintiff contended that defendant railroad company obstructed a stream by negligently piling into such stream carloads of rocks in an effort to riprap a railroad bed. Plaintiff contended that such obstruction dammed the flow of water in the stream, thereby causing it to back up and overflow onto plaintiff's land. Defendant contended that the flooding had resulted from excessive rainfall and that the creek could not have held all the water even if the rocks had not been in the stream. Defendant thus contended that the rocks were not a proximate cause of the flooding. The court stated that the issue of proximate cause was a jury question. The court in affirming, held that there was sufficient evidence to support the jury's verdict that the rock had been a proximate cause of the flooding. (Snow-Florida)
W71-02397

FRANK V DIERSON (LIABILITY FOR ALTERATION OF NATURAL DRAINAGE DIRECTION).
235 Ky 229, 30 SW2d 950-952 (1930).

Descriptors: *Kentucky, *Surface drainage, *Surface runoff, *Alteration of flow, Drainage, Runoff, Drainage water, Overland flow, Surface waters, Judicial decisions, Diversion, Flow, Natural flow, Legal aspects, Relative rights.

In an action for damages, plaintiff contended that defendant, owner of an adjoining lot, had so filled and elevated his lot so as to divert the natural drainage of surface water and to cast such upon plaintiff's lot. Plaintiff contended that prior to defendant's acts the drainage had been away from plaintiff's lot, but now surface water was cast upon plaintiff's lot, thereby causing much damage. Defendant contended that the evidence was insufficient to establish that he had altered the course of natural drainage. The court held that there was ample testimony and evidence to support plaintiff's contention. The court thus ruled that defendant was liable for damages caused by the diversion of surface water onto plaintiff's land. (Snow-Florida)
W71-02398

WALTER V WAGNER (FLOOD DAMAGE CAUSED BY LANDFILL).
225 Ky 255, 8 SW2d 421-422 (1928).

Descriptors: *Kentucky, *Surface runoff, *Landfills, *Damages, Land utilization, Flood damage, Relative rights, Land tenure, Walls, Legal aspects, Surface waters, Repulsion (Legal aspects), Riddance (Legal aspects), Adjudication procedure.
Identifiers: *Temporary.

Plaintiff and defendant owned adjacent plots of land. Defendant had filled his land, raising the surface of the property above that of plaintiff, and plaintiff had obtained a judgment against defendant for damage resulting from the runoff from defendant's property. Plaintiff subsequently sought damages resulting from another rainfall, and sought to recover the cost of building a wall capable of protecting his lot from the overflow. Defendant claimed that the former judgment was a bar to the subsequent action. The court held that the fill must be considered a temporary condition, as it could be regraded at any time. Therefore, plaintiff could bring an action for each injury suffered. It was proper for defendant to attempt to minimize damages by constructing a wall. Moreover, the fact that defendant had sold the property before the latter action was brought did not relieve defendant of liability, as defendant had created the condition in the first instance. (Caldwell-Florida)
W71-02399

KIGER V SANKO (DAMAGE CAUSED BY EXCESSIVE SURFACE RUNOFF).

1 SW2d 218-223 (Mo 1927).

Descriptors: *Missouri, *Repulsion (Legal aspects), *Surface runoff, *Riddance (Legal aspects), Surface waters, Floods, Flood damage, Ditches, Barriers, Alteration of flow, Obstruction

to flow, Drainage practices, Legal aspects, Relative rights, Drainage water, land tenure, Damages, Embankments.

Plaintiffs and defendants owned adjacent tracts of land. Originally, a ditch which ran through defendants' property channeled surface runoff over portions of the respective tracts so as to cause no damage. Plaintiffs alleged that defendants had filled this ditch and constructed new ones, resulting in large amounts of drainage being cast upon plaintiffs' property with destructive force. Plaintiffs had built an embankment along the common boundary to block flow from these ditches, but this embankment was broken by the flood waters. The court held that, while under the 'common enemy' rule a landowner had the right to rid himself of surface waters, he did not have the right to discharge water in destructive quantities onto adjacent property. The court rejected defendants' contention that the break in plaintiffs' embankment, rather than defendants' actions, had caused the damage. Plaintiffs were not required to build the embankment in the first place. Moreover, the presence of the embankment gave defendants no right to dig ditches in such a way as to cast water upon plaintiffs' land. (Caldwell-Florida)
W71-02400

ROSITZKY V BURNES (FLOOD DAMAGE TO ADJACENT BUILDING CAUSED BY OVERFLOW FROM ROOF).
295 SW 830-833 (Mo 1927).

Descriptors: *Missouri, *Drains, *Structures, *Flood damage, Obstruction to flow, Rainfall, Overflow, Pipes, Storm drains, Legal aspects, Drains, Floods, Leases, Screens, Barriers, Roofs, Land tenure.

In an action to recover water damages, plaintiff alleged that defendant had allowed gravel and other trash to accumulate on defendant's roof. During heavy rainfall, runoff from defendant's roof overflowed onto plaintiff's adjacent building, carrying with it much of this trash and clogging plaintiff's drains. Water was therefore backed up into plaintiff's building, causing flood damage. The court found that plaintiff's drains were negligently clogged. However, defendant contended that it did not occupy the premises in question, but leased it to a third party, and that under Missouri law a lessor was not liable for such damage caused while the tenant was in possession. The appellate court, however, found that there was no allegation or evidence of any lease in the record. Defendant was therefore held liable for the damage caused by the overflow. (Caldwell-Florida)
W71-02401

YOUNG V ILLINOIS CENT RR (RAILROAD EMBANKMENT ALLEGED TO HAVE OBSTRUCTED NATURAL DRAINAGE, CAUSING FLOOD DAMAGE).
220 Ky 322, 295 SW 156-158 (1927).

Descriptors: *Kentucky, *Obstruction to flow, *Overflow, *Railroads, Embankments, Drainage, Natural flow, Ditches, Barriers, Right-of-way, Rivers, Flood damage, Costs, Structures, Floods, Legal aspects, Judicial decisions, Alteration of flow, Damages, Land tenure, Surface waters, Surface runoff.

Defendant railroad had constructed an embankment over plaintiffs' land, blocking the natural drainage of the property. A ditch had been constructed parallel with the embankment to drain the property, but it had become clogged. Plaintiffs sought damages when surface runoff overflowed their property. Affirming a lower court decision for the defendant, the court held that plaintiffs could not recover as the railroad had no duty to maintain the ditch or to provide for the drainage of plaintiffs' land. The ditch was found not to be within the railroad's right-of-way, but on plaintiffs' property. No evidence was found as to who constructed the ditch, or any surrounding circumstances. Also, since plaintiffs had purchased the property after the ditch had become clogged, they were presumed to have known of the situation. There was no evidence that plaintiffs had any expectation that the railroad would maintain the ditch. (Caldwell-Florida)
W71-02402

CALDWELL V GORE (INTERSTATE SURFACE RUNOFF: LOWER SERVITUDE).
175 La 501, 143 So 387-388 (1932).

Descriptors: *Louisiana, *Natural flow, *Repulsion (Legal aspects), *Interstate, Streams, Dams, Flow, Streamflow, Arkansas, Adjudication procedure, Judicial decisions, Legal aspects, Riparian rights, Alteration of flow, Obstruction to flow, Relative rights, Drainage, Drainage water, Running waters, Downstream, Upstream, Riddance (Legal aspects).
Identifiers: *Servitudes.

Plaintiff upland owner owned property in Arkansas. Defendant lower landowner's property was in Louisiana. A stream ran from north to south through the parties' land into a lake on defendant's Louisiana property. Defendant erected a dam on his property impounding water on plaintiff's Arkansas land. Plaintiff sought to have the dam removed, claiming that under Louisiana law the proprietor of a lower estate owes a servitude to an upper estate to receive all the natural drainage therefrom. Under the common law and Arkansas law, no such servitude existed. Both parties were Louisiana residents. The Supreme Court of Louisiana agreed with plaintiff. A lower estate in Louisiana owes servitude to an upper estate in Arkansas to receive all the natural drainage therefrom. Louisiana law will be applied in an action by Louisiana residents owning property in Arkansas against Louisiana proprietors for an act done in Louisiana. (Dye-Florida)
W71-02403

ROBERTSON V BROOKSVILLE AND I RY (CONDEMNATION OF ACCESS TO WATER NECESSARY FOR RAILROAD OPERATION).

129 So 582-587 (Fla 1930).

Descriptors: *Florida, *Condemnation, *Right-of-way, *Access routes, Eminent domain, Legal aspects, Judicial decisions, Adjudication procedure, Easements, Railroad relocation, Real property, Land tenure, Railroads, Transportation, Water rights, Water supply.

Plaintiff railroad sought to condemn access to a supply of water on defendant's property. Plaintiff contended that a railroad might condemn any property reasonably necessary for its operation. Defendant contended that plaintiff had acquired no rights in the water sought to be removed, even though it had been removing it for some time without legal right. The Supreme Court of Florida reversed a trial court judgment for plaintiff. Though a railroad may condemn property necessary for its operation, such an action may not be used to accomplish a futile act. It would be futile to allow condemnation of a right-of-way to a water supply to the use of which plaintiff has no right. Defendant might first be allowed to condemn the water rights, after which right of access might be obtained by eminent domain. (Dye-Florida)
W71-02404

MEYERS V BEAUCHAMP (RIGHT OF RIPARIAN OWNER TO PROTECT HIS LAND).
51 SW2d 545-547 (Mo 1932).

Descriptors: *Missouri, *Riparian rights, *Bank erosion, Riparian land, Riparian waters, Alteration of flow, Watercourses (Legal), Beaches, Gravel, Bridges, Highways, Highway effects, Dams, Erosion, Relative rights, Natural flow, Natural flow doctrine, Judicial decisions, Legal aspects, Obstruction to flow.

Plaintiff and defendant owned land on opposite sides of a river. Plaintiff sought to enjoin defendant from placing obstructions in the river on defendant's side. Defendant counterclaimed and sought to enjoin plaintiff from placing obstructions in a similar manner on his side of the river. The court found that defendant did nothing more than protect his land from being washed away by the current as altered by plaintiff's action. Defendant had a right to protect his land against the waters of the river so long as he did so with due regard for the rights of other riparian owners and did not change the current of the stream so as to injure the banks of a lower or opposite riparian owner. The judgment below dismissing all parties' claims was affirmed. (Price-Florida)
W71-02405

HUTCHINGS V WABASH RY (UPSTREAM OWNER'S DIVERSION OF WATERCOURSE).
For primary bibliographic entry see Field 04A.
W71-02406

BRATSCHI V LOESCH (RIPARIAN OWNERS OWN TO THE CENTER OF NON-NAVIGABLE STREAMS).
51 SW2d 69-72 (Mo 1932).

Descriptors: *Missouri, *Non-navigable waters, *Boundaries (Property), *Thalwegs, Boundary disputes, Accretion (Legal aspects), Avulsion, Gravel, Legal aspects, Judicial decisions, Channel morphology, Ownership of beds, Beds under water, Real property.

Plaintiff riparian owner brought action to quiet title to a gravel bar located between the bank of the river on which his property abutted and the thread of such river. Defendant contended that plaintiff's property extended only to the bank of the river or in the alternative, that the river had undergone an avulsive change in course, and therefore the true dividing line between his property and that of plaintiff was the center of the river as it ran originally. Consequently, the gravel bar was within defendant's boundaries. The court stated that where a non-navigable stream constitutes the dividing line between two tracts of land, each owner takes to the center of said stream. Where the change in the course of the stream which forms such boundary is slow and gradual, as in the instant case, the boundary line changes with the stream, and thus the center of the stream continues to be the boundary. The trial court's judgment for plaintiff was affirmed. (Price-Florida)
W71-02407

FRIZZELL V LOWE (OWNERSHIP OF ISLAND IN NON-NAVIGABLE RIVER).
294 SW 996-998 (Ark 1927).

Descriptors: *Arkansas, *Islands, *Federal government, *Patents, Public lands, Non-navigable waters, Thalweg, Riparian rights, Shores, Swamps, Meanders, Land tenure, Judicial decisions, Legal aspects, Taxes, Real property, Relative rights.

Plaintiff brought action to enjoin defendant from taking timber from a small island in the Little Missouri River which she claimed through a patent from the Department of the Interior. Defendant claimed the island through a tax deed from the state. The issue was whether the United States had conveyed the tract here involved to the state through a swamp land patent of 1855. The court found that the land had been excluded from the patent, that title to the land had remained in the United States and that plaintiff was the owner of said land through the patent from the Department of the Interior. The court stated that ownership of the land opposite an island would carry with it riparian rights to the thread of the stream, which would include any ordinary island to be expected in

a non-navigable stream, but as defendant was not such an owner, he was in no position to raise the question of riparian rights. The judgment for plaintiff was affirmed. (Price-Florida)
W71-02408

CLINCHFIELD COAL CORP V COMPTON (DIVERSION OF PERCOLATING WATER).
139 SE 308-313 (Va 1927).

Descriptors: *Virginia, *Diversion, *Groundwater, *Percolating water, Percolation, Adjudication procedure, Judicial decisions, Legal aspects, Land, Land tenure, Real property, Subsurface waters, Obstruction to flow, Underground streams, Damages, Mining, Coal mines, Underground, Underground structures.

Defendant's mining shaft collapsed, obstructing the flow of groundwater beneath plaintiff's property. Plaintiff contended that: (1) defendant's shaft extended beneath plaintiff's land; and (2) the underground water flowed in a defined channel and was subject to the diversion limitations of surface streams. The Supreme Court of Appeals of Virginia reversed a trial court judgment for plaintiff. Evidence showed that defendant's shaft was entirely beneath its own property, as was the source of the diverted groundwater. Percolating water is that which may not be inferred by surface conditions to have a defined channel. An owner of land, so long as no malice is involved, may make any reasonable use of the percolating water beneath his land, even if such use results in diversion of water from the lands of others. No malice was alleged in the instant case, and there was not evidence that the water diverted was not percolating water. (Dye-Florida)
W71-02409

HARTZELL V VILLAGE OF HAMBURG (VILLAGE BOUND TO ACQUIRE WATER SUPPLY FOR PUBLIC USE BY CONDEMNATION OR GRANT).
155 Misc 345, 279 NYS 650-658 (1935).

Descriptors: *New York, *Municipal water, Dams, Governments, Artificial use, Beneficial use, Damages, Concrete structures, Obstruction to flow, Reservoirs, Legal aspects, Judicial decisions, Riparian rights, Riparian land, Streams, Natural flow, Condemnation, Compensation, Grants, Diversion.

Plaintiff riparian landowners sought to enjoin defendant village from taking the water of a stream which in its natural course flowed through the lands of plaintiffs. Plaintiffs contended that defendant had dammed the stream and diverted all of its water for the village's inhabitants' domestic uses and had damaged their lands without compensation. Plaintiffs further maintained that defendant collected considerable revenues from the sale of the water diverted. Defendant contended that plaintiffs' action was barred by laches and that defendant had acquired a prescriptive right to the water. The court held that although the village had a statutory right to acquire an adequate water supply, it was bound to acquire such supply by grant or condemnation. Although defendant took most of the stream's water for six years, it did not acquire a prescriptive right to withdraw the water without just compensation to the riparian owners. (Quesada-Florida)
W71-02410

SCHOFIELD V DINGMAN (RIPARIAN RIGHTS OF OWNERS OF LAND WHICH DOES NOT ABUT LAKE).
261 Mich 611, 247 NW 67-68 (1933).

Descriptors: *Michigan, *Banks, *Riparian land, *Easements, Remedies, Relative rights, Navigable waters, Legal aspects, Judicial decisions, Lakes, Boundaries (Property), Shores, Prescriptive rights, Riparian rights, Access routes, Real property, Land tenure, Recreation.

Plaintiff landowners filed an action challenging the claims of defendant riparian landowner to the ownership of the riparian land situated between plaintiffs' land, which overlooked a navigable lake, and the waterline. Plaintiffs contended that their vendor had conveyed to them land on a bluff overlooking the shoreline of the lake with the assurance that they had riparian rights to the land between the bluff and the waterline. Plaintiffs further claimed title to the land by adverse possession, contending that they had built certain structures upon it. Defendant contended that he had acquired the vendor's rights to the land in question upon the vendor's death. Defendant maintained that since the vendor had not conveyed the property to plaintiffs at the time of the original conveyance, the vendor had retained title to it, which had in turn passed to the defendant. The Supreme Court of Michigan held that: (1) riparian rights granted to plaintiffs whose lots were separated from the lake by intervening land gave only an easement appurtenant; (2) plaintiffs had no more than the right of access to the land for recreation; and, (3) the construction of several structures on the land was of too temporary a nature to indicate adverse possession by plaintiff. (Quesada-Florida)
W71-02411

BUSH V CITY OF ROCHESTER (LIABILITY FOR EXPULSION OF SURFACE WATERS UPON LAND OF ANOTHER BY CONSTRUCTION OF A ROAD).
255 NW 256-258 (Minn 1934).

Descriptors: *Minnesota, *Surface drainage, *Drainage water, *Surface waters, Drainage, Damages, Riddance (Legal aspects), Surface runoff, Water spreading, Overland flow, Rain water, Judicial decisions, Drainage effects, Cities, Roadbanks, Roads, Road construction, Diversion.

In an action for damages, plaintiff contended that defendant municipality in building a graded street adjacent to plaintiff's property did not provide for the drainage of surface water. As a result, plaintiff contended that excessive surface water was cast upon his property, thereby damaging it. Defendant contended that the improvement caused no additional surface water to be diverted over plaintiff's land. The court held that surface water could be expelled from one's property. The court also held that the spread and diffusion of water over adjacent land is a necessary consequence of improvements. However, the disposition of surface water must be reasonable and the injury from such disposition to adjacent owners cannot exceed the benefit derived. The court examined the evidence and ruled that it supported the conclusion that the construction of the road had caused an unreasonable diversion of surface water upon plaintiff's land. The jury verdict awarding plaintiff damages was therefore sustained. (Snow-Florida)
W71-02412

FENNEMA V NOLIN (CONSTRUCTION OF DITCH JUSTIFIED WHERE DISCHARGE OF WATER WAS ABOUT SAME AS UNDER THE NATURAL COURSE OF SAID DITCH).
212 NW 702-705 (Iowa 1927).

Descriptors: *Iowa, *Ditches, *Natural flow doctrine, *Backwater, Natural flow, Judicial decisions, Legal aspects, Dams, Outlets, Channel morphology, Channel flow, Channel improvement, Diversion losses, Diversion structures, Tile drains, Overflow, Surface waters, Accretion (Legal aspects).

Plaintiff trustees brought action to enjoin defendant from maintaining a drainage ditch on his lands and from maintaining a dam which plaintiffs alleged was located in an old water channel. Plaintiffs contended that such constructions diverted water onto defendant's land in such a way as to cause water to back up on plaintiffs' land and prevent proper drainage thereof. The court ruled that defendant was justified in constructing the ditch on his land, and thereby expediting the flow and discharge of water at about the same point where the water was naturally discharged. The evidence failed to show the backwater appreciably interfered with the free flow of water from plaintiffs' property. Neither was defendant responsible for the natural accretions or obstructions that naturally effected the closing of the old water channel even though it resulted in the backing up of water on plaintiff's lands. The judgment for plaintiff was reversed in part and modified in part. (Price-Dale)
W71-02413

PLEASANT LAKE HILLS CORP V EPPINGER (RIPARIAN RIGHTS IN LAKE WHERE BED OWNERSHIP IS IN ANOTHER RIPARIAN OWNER).
235 Mich 174, 209 NW 152-154 (1926).

Descriptors: *Michigan, *Ownership of beds, *Boundaries (Property), *Riparian rights, Beds under water, Boundary disputes, Lakes, Riparian land, Fishing, Boating, Swimming, High water mark, Low water mark, Water rights, Remedies, Judicial decisions, Legal aspects.

Plaintiff corporation sought to enjoin defendant from exercising riparian rights on a lake upon which both parties were riparian owners. An earlier decision by the Michigan Supreme Court had determined that plaintiff's predecessor was the exclusive owner of the entire lake bed. Defendant claimed that the grant to plaintiff's predecessor had reserved in defendant the right of entry onto the lake. Moreover, defendant claimed that he had established title to the narrow strip between the high and low water marks of the lake through adverse possession. The court ruled that no adverse possession had been established, and since it had previously been established that plaintiff's grantor had exclusive ownership of the lake bed, defendant had no riparian rights in the lake. The injunction was granted. (Barker-Florida)
W71-02414

CRAMER V PERINE (TITLE TO ACCRETION DETERMINED BY EXTENSION OF EXISTING BOUNDARIES).
251 NY 177, 167 NE 213-217 (1929).

Descriptors: *New York, *Boundary disputes, *Accretion (Legal aspects), *Boundaries (Property), Riparian land, Streams, Banks, Judicial decisions, Remedies, Legal aspects.

Plaintiff riparian landowner sought to eject defendant neighboring landowner from accretions formed to their lands by a stream which served as a boundary of both plots. Plaintiff claimed that the deed, to his predecessors, from the common grantor of both parties, stated that the division line of the properties was to meet the stream at a specified angle. Plaintiff contended that the old boundary line should be extended on this angle to establish the new boundary on the accretion. Defendant argued that the line should be extended from the old boundary-stream intersection point so as to meet the stream at a right angle. The New York Court of Appeals ruled that in light of the special circumstances of the controversy, title to the accretions should be determined by extending the line from the old intersection point so that it intercepted the stream at right angles. Thus, the accreted land was equally divided between the riparian owners. The lower court's judgment for plaintiff was reversed. (Barker-Florida)
W71-02415

BEECHLEY V HARMS (INJUNCTION AGAINST INTERFERENCE WITH NATURAL DRAINAGE).
332 Ill 185, 163 NE 387-389 (1928).

Descriptors: *Illinois, *Obstruction to flow, *Repulsion (Legal aspects), *Surface runoff, Drainage, Surface drainage, Natural flow, Dams, Damsites, Levees, Earthworks, Flood protection, Prescriptive rights, Barriers, Remedies, Judicial decisions, Legal aspects.

Identifiers: *Servitudes.

Plaintiff landowners sought to enjoin defendant from maintaining a dam. The dam prevented water from draining from plaintiffs' lands onto defendant's property. Defendant claimed that there was no natural drainage onto his land and that the dam had existed on his property for over twenty years, thus giving him a prescriptive right to maintain it. The trial court found that defendant's estate was servient to plaintiffs' properties and that defendant had increased the height of the dam. The Surpeme Court of Illinois, affirming the lower court's ruling, held that servient property is obligated to receive natural drainage from dominant estates. Defendant's act of increasing the dam's height was in opposition to such obligation. The injunction was granted. (Barker-Florida)
W71-02416

HORNICK V BETHLEHEM MINES CORP (LIABILITY FOR DRYING UP OF SPRINGS RESULTING FROM UNDERGROUND MINING).

307 Pa 264, 161 A 75-77 (1932).

Descriptors: *Pennsylvania, *Springs, *Drying, *Mining, Spring waters, Subsurface waters, Underground, Groundwater, Water loss, Dry beds, Judicial decisions, Coal mines, Mining engineering, Legal aspects, Damages, Relative rights.

Plaintiff brought an action for damages based on an alleged drying up of springs on his property. Plaintiff contended that defendant mining company caused these springs to be dried up permanently by the removal of coal underneath plaintiff's farm. Defendant contended that it had a legal right to remove the coal and that no causal connection had been established between the drying up of the springs and defendant's mining operations. The court held that defendant had the right to mine the coal but that it was liable for any damages the mining did to the surface. The court ruled that evidence to the fact that the springs dried up at the times when mining was done directly under them was sufficient to establish a causal connection between the mining and the drying up of the springs. The jury verdict awarding plaintiff damages was sustained. (Snow-Florida)
W71-02417

ALLIANCE MILLS CO V SOCIETY FOR ESTABLISHING USEFUL MANUFACTURES (GRANTS OF FLOWAGE RIGHTS).
142 A 49-50 (NJ 1928).

Descriptors: *New Jersey, *Adjudication procedure, *Water utilization, *Relative rights, Water supply, Water distribution (Applied), Judicial decisions, Legal aspects.

Plaintiff mill company sought to enjoin defendant society from granting flowage rights in a watercourse to a third person, claiming that such grants would interfere with plaintiff's earlier grant of such right. Defendant moved to dismiss the equity action on the ground that the alleged interference was compensable by damages in law. The New Jersey Court of Chancery denied the motion to dismiss, saying that evidence on both sides should first be heard. (Barker-Florida)
W71-02418

COURTER V BOROUGH OF LINCOLN PARK (LOCATION OF BOUNDARY DESCRIBED AS A RIVER WHEN THE RIVER CHANGES LOCATION).
138 A 99-103 (NJ 1927).

Descriptors: *New Jersey, *Boundaries (Property), *Boundary disputes, *Dry beds, Rivers, Avulsion, Accretion (Legal aspects), River beds, Beds, Channels, Judicial decisions, Cities, Taxes, Assessments, Channel morphology.

Plaintiff brought an action to determine which of two municipalities had the right to assess and collect taxes on his land. The land in question was located between a fork of two branches of a river which was the boundary of the two municipalities. The municipality west of the land contended that the eastern branch was the boundary. The eastern municipality contended that the western branch was the boundary. The evidence showed that the western branch had originally been established by the legislature as the boundary. However, the western branch had subsequently dried up and the eastern branch now carried all the water of the river. The western municipality thus contended that the boundary had shifted to the east branch of the river by reason of the western branch drying up. The court ruled that when a boundary line has been once fixed, a subsequent change in the status of the waters does not have the effect of shifting the boundaries. The western branch thus remained the boundary, and the eastern municipality could assess the property between the two branches for taxes. (Snow-Florida)
W71-02419

MAYLENDER V FULTON COUNTY GAS AND ELEC CO (LIABILITY FOR OBSTRUCTION OF NATURAL FLOW).
131 Misc Rep 514, 227 NYS 209-218 (1928).

Descriptors: *New York, *Dams, *Riparian water loss, *Electric power industry, Riparian rights, Riparian land, Reasonable use, Riparian waters, Natural flow, Streams, Streamflow, Public utilities, Water storage, Flow control, Overflow, Priorities, Legal aspects, Judicial decisions, Remedies, Damages, Impoundments, Impounded waters, Obstruction to flow.

Plaintiff lower riparian owner brought action against defendant hydroelectric company for damages allegedly caused by defendant unreasonably reducing and increasing, at various times, the natural flow of a certain creek. Defendant moved to dismiss for failure to state facts showing a cause of action. The facts alleged were that the defendant for 12 years had impounded waters, thereby depriving plaintiff of his rights as a lower riparian owner, and occasionally had discharged large quantities of water. The court granted the motion to dismiss, stating that plaintiff had failed to allege legal injury or show how he was deprived of any right. The court noted that every riparian owner has a right to construct a dam and temporarily detain natural flow for rightful purposes. Each riparian owner is entitled to receive the natural flow except as occasioned by reasonable use of an upper riparian owner who is entitled to first use. (Morris-Florida)
W71-02420

LOWE V INDIANA HYDROELECTRIC POWER CO (CONDEMNATION POWER OF ELECTRIC UTILITY).
151 NE 220-226 (Ind 1926).

Descriptors: *Indiana, *Eminent domain, *Public utilities, *Damsites, Legal aspects, Judicial decisions, Remedies, Riparian land, Condemnation, Compensation, Easement, Right-of-way, Public rights, Electric power, Dam construction, Overflow, Water control, Non-navigable waters, Riparian rights, Rivers, Natural flow doctrine, Legislation.

Plaintiff electric company sought to condemn lands owned by defendant which would be overflowed by water after a dam planned by plaintiff was completed. Defendant contested plaintiff's right to condemn the land without obtaining a certificate of necessity from the state Public Service Commission. Plaintiff owned land on both sides of a non-navigable river. The court held that such ownership gave plaintiff the right to use of the water in the river unless the use damaged other property by retarding the flow or causing other injury. That right would not give plaintiff the right to submerge defendant's land, but the court held that a state statute did give the right of condemnation to and electric utility. The court ruled also that a subsequent statute requiring a certificate of necessity was not applicable to companies covered by the first statute. The trial court's judgment for plaintiff was affirmed. (Morris-Florida)
W71-02421

EAST BAY SPORTING CLUB V MILLER (OWNERSHIP OF NON-NAVIGABLE WATERS).
118 Ohio St 360, 161 NE 12-16 (1928).

Descriptors: *Ohio, *Public rights, *Non-navigable waters, *Fishing, Ownership of beds, Riparian rights, Riparian waters, Navigable waters, Streams, Lakes, Lake Erie, Watercourses (Legal), Tides, Tidal marshes, Fish management, Recreation, Fish conservation, Wildlife, Legal aspects, Judicial decisions, Remedies, Relative rights.

Plaintiff sporting club and game preserve asked that defendant fishermen be enjoined from trespassing on its property, claiming they disturbed breeding grounds and scared wildfowl. Defendants answered that they had the right to fish in navigable waters. Plaintiff's land bordered on Lake Erie, and the waters in question, a lake and two streams, were accessible from such lake. The lower court ruled for defendants, and denied the injunction. The Supreme Court of Ohio agreed the open body of water was part of the bay and thus public, but it enjoined defendants from use of the two streams. The court stated the streams were defined watercourses and did not lose that definition because the water level rose with the tide. Nor could such streams be considered navigable under the definition of water capable of use as a commercial highway. Flat-bottomed fishing boats are not commerce, and, since the streams flowed only from plaintiff's private land, they were owned by plaintiff. (Morris-Florida)
W71-02422

KLEINBERG V RATETT (CONDUIT CARRYING NATURAL STREAM UNDER PROPERTY DOES NOT CONSTITUTE ENCUMBRANCE AGAINST TITLE).
252 NY 236, 169 NE 289-290 (1929).

Descriptors: *New York, *Natural flow doctrine, *Natural streams, *Riparian rights, Legal aspects, Remedies, Riparian land, Easements, Banks, Ownership of beds, Culverts, Channels, Riparian waters, Pipes, Surface waters, Natural flow, Judicial decisions, Relative rights, Real property.

Plaintiffs sought recission of a contract to buy land on the grounds it was encumbered by an easement for a stream which passed through a culvert under the property. Defendant asked for specific performance for the sale, claiming no easement existed. The Court of Appeals of New York reversed a lower court decision granting recission, but declined to order specific performance. The court said the only rights the upper and lower riparian owners had against the property were the natural rights to have the stream flow through its ancient channel. Such a right is not an easement. The conduit which carried the stream under the property was not constructed under agreement with any other owner, nor had it existed for more than 20 years, so no one had any right to enforce maintenance of the pipe; thus there was no encumbrance on the title. (Morris-Florida)
W71-02423

CARETTI V BRORING BLDG CO (LIABILITY FOR POLLUTION OF STREAM).
132 A 619-624 (Md 1926).

Descriptors: *Maryland, *Riparian rights, *Water pollution, *Domestic wastes, Legal aspects, Judicial decisions, Remedies, Water pollution control, Water pollution effects, Water pollution treatment,

Abatement, Waste disposal, Sewage disposal, Septic tanks, Cesspools, Streams, Riparian land, Wastes, Sewage, Local governments.

Plaintiff riparian landowner sought an injunction to prevent defendant land development company from discharging sewage from its development into a stream. The development drained its sewage and waste water from 70 houses into the stream, which had turned from clear to slimy and smelly in a few years. Plaintiff also claimed increased volume was causing the stream to enlarge. Defendant contended conditions were not as bad as portrayed, and that there were other contributors to the pollution. The Maryland Court of Appeals reversed a lower court's judgment for defendant and issued an injunction. The court stated that a riparian owner has a right to receive water in its natural purity and quantity, and the fact that there was more than one polluter was no help to defendant. The court declined to rule against defendant on the quantity of water, however, and allowed defendant a reasonable time to stop pollution in order not to hamper the health of the development's homeowners. (Morris-Florida)
W71-02424

MARINE LIGHTERAGE CORP V LUCKENBACH SS CO (WHARFAGE CHARGES).
139 Misc 612, 248 NYS 71-75 (1931).

Descriptors: *New York, *Regulation, *Docks, *Tariff, State governments, Federal government, Adjudication procedure, Judicial decisions, Legal aspects, United States, Taxes, Costs, Government finance, Governments, Administration, Contracts, Piers, Supervisory control (Power), Regulation.

Plaintiff corporation sought a declaratory judgment relieving it of wharfage charges levied by defendant wharf owner. The Supreme Court of New York dismissed the complaint. Wharfage is a charge for use of a wharf by way of rent. Duty of tonnage is a tax imposed for the privilege of using a harbor, and can only be imposed by Congress. Wharves may be regulated by the state in which they are located, in the absence of congressional legislation, if state statutes doe not discriminate against interstate commerce. Defendant was entitled to exclusive use of his wharf as regulated by the state. Complete relief was available to plaintiff under the statutes relating to wharfage, and therefore plaintiff was not entitled to a declaratory judgment. (Dye-Florida)
W71-02426

VROOMAN V STATE (LIABILITY FOR FLOOD DAMAGE).
141 Misc 786, 253 NYS 268-275 (Ct Cl 1931).

Descriptors: *New York, *Damages, *Floods, *Land development, Dams, Overflow, Running waters, Flooding, Accidents, Flood damage, Legal aspects, Remedies, Judicial decisions, Structures, Flood control, Islands, Impoundments, Impounded waters.

Plaintiff landowner brought an action for damages against defendant state alleging that the raising of the surface elevation of a state-owned island caused flood damage to his upstream property. Plaintiff contended that the raised surface elevation of the island located in the river upon which his property abutted caused the river to overflow its banks when a large quantity of water flowed downstream after an ice jam. Plaintiff maintained that if the island had not been raised, the water would not have backed up, and thus no flooding would have occured. Defendant contended that there was no evidence to show that the raised level of the island caused the flooding. The court, in holding for defendant, ruled that the evidence was insufficient to warrant a finding that the raised surface elevation of the island caused the upstream flooding. (Quesada-Florida)
W71-02472

MACRUM V HAWKINS (REGULATION OF BRIDGE CONSTRUCTION).
235 App Div 370, 257 NYS 287-296 (1932).

Descriptors: *New York, *Navigable waters, *Federal jurisdiction, *State jurisdiction, Bridge construction, Bridges, Highways, Tidal waters, Obstruction to flow, Navigation, Federal government, State governments, Judicial decisions, Legal aspects, Dredging, Public benefits, Taxes, Legislation Local governments, Regulation, Supervisory control (Power).

Plaintiff taxpayers sought to enjoin the implementation of a resolution by defendant Board of Supervisors relating to the construction of certain bridges and highways. Plaintiffs contended, among other things, that the construction of the proposed bridges would interfere with the full flow of tidal waters and impede navigation. The bridges were to span navigable waters wholly within the state. The court stated that congressional approval of the construction of such bridge was not required if the plans were approved by the War Department. When the government approves such a project as was here involved, it is a lawful project even though it interferes somewhat with navigation and the full flow of tidal waters. However, Congress can compel the removal of such bridges when necessary to aid navigation. The authority of the state over waters within the state is plenary and subject only to the power of Congress to regulate interstate commerce. The judgment dismissing plaintiffs' complaint was affirmed. (Price-Florida)
W71-02473

MACRUM V BOARD OF SUP'RS (AUTHORITY OF LOCAL GOVERNMENTS TO BRIDGE NAVIGABLE WATERS).
141 Misc 358, 252 NYS 546-555 (1931).

Descriptors: *New York, *Bridge construction, *Supervisory control (Power), *State governments, Local governments, Federal government, Legislation, Administration, Judicial decisions, Legal aspects, Rivers, Navigable waters, Governments, Administrative agencies, Government finance, Navigable rivers, Highways, Bridges, Project planning, Administrative decisions.

Plaintiff taxpayers sought to enjoin the issue of bonds by defendant county board of supervisors for the construction of bridges over navigable waters of the state. Plaintiffs contended that: (1) authorization of Congress was necessary for the erection of bridges over navigable waters, (2) the ordinance authorizing the bonds was invalid as it was not authorized by special act of the state legislature, and (3) the general legislative acts regarding highways were not broad enough to authorize construction of bridges over navigable waters. The Supreme Court of New York held for defendants. The River and Harbor Appropriation Act allows construction of bridges over navigable rivers without congressional approval when the navigable portions of such rivers lie wholly within a single state. The New York constitution prohibits authorization of bridge construction by special act. The power of the state over such bridges is plenary and delegable. In the instant case the power to build bridges was properly delegated as part of the highway law which allowed counties to build bridges as part of their highway programs. (Dye-Florida)
W71-02476

A COMPARATIVE ANALYSIS OF AMERICAN AND CANADIAN GOVERNMENTAL ARRANGEMENTS FOR THE DEVELOPMENT OF REGIONAL WATER POLICY IN THE COLUMBIA RIVER BASIN,
Washington Univ., Seattle. Dept. of Political Science.
Robert Warren, and Geoffrey Wandesforde-Smith.
Available from NTIS as PB-196 116, $6.00 in paper copy, $0.95 in microfiche. Completion Report, September 1970. 306 p, append. OWRR A-031-Wash (1).

Descriptors: *Public rights, Public benefits, *Governments, *Water policy, Regions, Regional analysis, *Columbia River basin, Columbia River, *Water resources development, *Planning, *Legislation, United States.
Identifiers: Public goods, Regional planning, Environmental values, Planning personnel, Development policy, Diseconomies of scale, Federal system, State water planning, Bureaucratic behavior, Public entrepreneurship, Representation, Technological change.

Organizations created to plan and coordinate the programs of water-related agencies in the Pacific Northwest have consistently failed to induce relevant federal and state agencies to order their priorities in terms of regionally oriented criteria or significantly influence the way these units interact with one another. The study finds that contrary to widely held assumptions, long-range and finely planned regional programs involving the commitment of resources by autonomous entities can occur through entrepreneurial motivations on the part of major actors without central direction. At the same time, the system has build-in biases for continued use of the public goods presently produced by large water-agencies. There is strong resistence from these production agencies and planning personnel to the acceptance of criteria concerning the effect of water projects on the environment, urban areas and social conditions. State governments tend to underinvest in water planning and fail to act as equals with the federal government in joint planning organizations. In considering planning alternatives the study finds that the centralized control of water planning is not possible within the American political system and may be dysfunctional because of scale diseconomies. In British Columbia the Premier has used his powers to establish an integrated water resources development policy as a means to the end of overall economic development of the province. But such a model is not transferable because of differences in the distribution of authority in the two federal systems. The study concludes that the appropriate response to regional water resources development planning would be to increase the level of competition among actors rather than create a centralized mechanism. Proposed steps include stimulating state governments to act more vigorously in their own interest, better equip the existing regional agency, the Pacific Northwest River Basins Commission to carry out certain functions and establish an independent regional agency concerned with research and policy analysis.
W71-02499

MONGAUP VALLEY CO V ROCKLAND LIGHT AND POWER CO (LIABILITY FOR NEGLIGENT PREPARATION OF RESERVOIR BED).

258 NYS 731-739 (Sup Ct 1932).

Descriptors: *New York, *Reservoirs, *Beds under water, *Reservoir operation, Easements, Legal aspects, Judicial decisions, Hydroelectric plants, Damages, Dams, Reservoir storage, Reservoir design, Impoundments, Flooding, Overflow, Nuisance algae, Vegetation, Vegetation effects, Fouling, Reservoir construction, Odor, Odor-producing algae, Property values.

Plaintiff landowner sought to enjoin defendant corporation from maintaining an alleged nuisance and sought damages for alleged devaluation of his property adjacent to defendant's reservoir bed. Defendant had withdrawn the water from its reservoir. Plaintiff alleged that offensive odors emanated therefrom, that defendant's action created a nuisance, that the value of his property was reduced and that such injury was due to defendant's negligent preparation of the bed of the reservoir. Defendant contended that no nuisance had been created and that due care had been exercised in preparing the reservoir bed for flooding. The court ruled that whereas the project had been authorized by the legislature, the nuisance theory could not be relied on by plaintiff. For relief to be

granted, negligence had to be shown. The court held that plaintiff failed to bear the burden of proof as he did not show that defendant had not exercised ordinary care and skill in preparing the reservoir bed. Plaintiff's complaint was dismissed. (Price-Fla)
W71-02524

CITY OF LAWRENCE V MACDONALD (VALIDITY OF PIPELINE PERMIT ISSUED BY PUBLIC WORKS COMMISSIONER).
62 NE2d 850-859 (1945).

Descriptors: *Massachusetts, *Permits, *Pipelines, *Navigable rivers, Regulation, Water quality control, Local governments, Cities, Water supply, Intakes, Administrative decisions, Administrative agencies, Public rights, Public utilities, Water works, Legal aspects, Judicial decisions, Adjudication procedure, Oil industry.

Plaintiff city petitioned to quash a license granted by defendant public works commission authorizing an oil company to lay a pipeline in a navigable river a short distance upstream from plaintiff's water supply intake. The court noted that the city had standing to challenge the license because of its responsibility to provide a suitable water supply for its citizens, although other riparian owners might not have such standing. The court also noted that statutes giving control over water supplies to the Department of Public Health did not restrict defendant's authority to issue the license. However, the court quashed the license on other grounds. (Liptak-Florida)
W71-02526

WINCHESTER V BYERS (LIABILITY FOR ALTERING NATURAL FLOW OF SURFACE DRAINAGE).

196 NC 383, 145 SE 774-775 (1928).

Descriptors: *North Carolina, *Diversion, *Alteration of flow, *Surface drainage, Repulsion (Legal aspects), Riddance (Legal aspects), Legal aspects, Judicial decisions, Damages, Drainage, Rainfall, Excessive precipitation, Surface waters, Surface runoff, Rain water, Natural flow, Flow, Land forming, Landfill, Channels, Obstruction to flow, Flooding, Flood damage.

Plaintiff landowner sued defendant adjoining landowner for flood damages to his land and house allegedly caused by defendant's placing of dirt so as to divert the natural flow of surface drainage. Defendant contented excessive rains caused the damage. The Supreme Court of North Carolina, in affirming per curiam the trial court's judgment for plaintiff, stated that an owner of lower land is obliged to receive surface water which naturally flows from adjoining higher land, and the lower owner may not repel such water. However, the higher owner cannot artificially increase the natural quantity of water or change its natural manner of flow. (Morris-Florida)
W71-02527

ESSEX CO V GIBSON (MEASUREMENT OF WATER RIGHTS FOR MILL USE).
130 A 846-854 (NH 1925).

Descriptors: *New Hampshire, *Mills, Water rights, *Water measurement, Rivers, Dams, Sawmills, Mill dams, Hydraulic structures, Hydraulic machinery, Sluices, Water wheels, Closed conduits, Relative rights, Reasonable use, Preferences (Water rights), Water utilization, Legal aspects, Judicial decisions, Adjudication procedure, Water contracts, Prescriptive rights, Flumes.

Plaintiff sawmill owner sued defendant gristmill owner to ascertain and enforce their respective water rights in a river. Defendant's water rights were derived from a deed from plaintiff's predecessor limiting defendant's rights to the amount of water necessary to run 'three run of stones, corn cracker, and smut mill' and also limiting the width of a flume through which the water flowed. Plaintiff contended that defendant's water rights were limited to the amount of water necessary to operate the specified machinery using modern water wheels which were considerably more efficient than the old wheels. Defendant contended that he was entitled to the amount of water necessary to operate the old water wheels and whatever amount would flow through the specified flume width. Affirming the judgment for plaintiff, the court noted that there was no way of computing the water needed to run the old wheel, that the width of the flume was meaningless without any limitation on the depth and water velocity and that the conduct of both parties after the conveyance clearly indicated that they had contemplated the conversion to the more modern and efficient equipment. (Liptak-Florida)
W71-02528

MARKLE V GROTHE (COLLECTION AND DISCHARGE OF SURFACE WATER).
102 Pa Super 90, 156 A 585-587 (1931).

Descriptors: *Pennsylvania, *Riddance (Legal aspects), *Surface drainage, *Flooding, Repulsion (Legal aspects), Drainage water, Slopes, Small watersheds, Natural flow doctrine, Pipelines, Pipes, Discharge lines, Flood damage, soaking, Wetting, Judicial decisions, Legal aspects, Drainage systems, Surface runoff.

Plaintiff lower landowner sued defendant upper landowner for damages caused by discharge of surface water over plaintiff's property. Defendant excavated for clay in his brick manufacturing business. Surface water which collected in the excavations drained onto plaintiff's land. Plaintiff conceded defendant's right to repulse the surface water, but contended that spring water was also being discharged onto his land which exceeded defendant's right to repulse the water. The court observed that: (1) the upper landowner has a drainage servitude for natural drainage; (2) if unavoidable loss is sustained by the lower tenant without negligence by upper tenant in the exercise of the right to repulse surface water, there is no cause of action for the loss; and (3) the upper landowner cannot concentrate the surface water to be discharged unnaturally, thereby causing injury to the lower owner. The chancellor found that whatever damage plaintiff sustained was solely from discharge of surface water. Determining that the natural flow of surface water was not increased by defendant's actions, the court held that defendant was not liable for plaintiff's injury. The lower court's decision for defendant was affirmed. (Hart-Florida)
W71-02529

DICKINSON V NEW ENGLAND POWER CO (RELATIVE RIGHTS OF DAM OWNER AND LANDOWNER).
257 Mass 108, 153 NE 458-460 (1926).

Descriptors: *Massachusetts, *Dams, *Damages, *Relative rights, Legislation, Streams, Obstruction to flow, Flood damages, Water levels, Compensation, Easements, Flow, Land tenure, Reasonable use, Watercourses (Legal), Riparian rights, Riparian waters, Remedies, Mills, Overflow, Public rights, Legal aspects, Judicial decisions.

Plaintiffs sought to enjoin defendant power company from overflowing their lands without their consent. Defendant had constructed a dam across a non-navigable stream which occasioned the flooding of plaintiff's land above the dam. The same land and defendant had been the subject of a prior suit and petition for an injunction and compensation. The suit for an injunction had been dismissed because the dam was held to be one encompassed within a statute permitting construction of dams across non-navigable streams. The petition for compensation was dismissed as defendant was entitled to a reasonable use of the stream for lawful purposes, and the consequential injuries to petitioners' estates were not recoverable. The present suit was maintained on the theory that such flowing without compensation violated the federal and Massachusetts constitutions. The trial court sustained a demurrer to plaintiffs' bill and the Supreme Judicial Court of Massachusetts affirmed. The statute which permitted construction of such dams was consitutional and adequately protected those who suffered more than incidental damages. If plaintiffs' damages had amounted to a nuisance, they would have had a remedy at law. However, if their damage was not a nuisance, it was demnum adsque injuria. (Duss-Florida)
W71-02530

NORTHERN OHIO TRACTION AND LIGHT CO V QUAKER OATS CO (GRANT OF MILLRACE IS REAL PROPERTY, NOT AN EASEMENT).
114 Ohio St 685, 152 NE 5-10 (1926).

Descriptors: *Ohio, *Artificial watercourses, *Water contracts, *Real property, Legal aspects, Judicial decisions, Damages, Prescriptive rights, Rivers, Natural flow, Watercourses (Legal), Ownership of beds, Channels, Flow, Water levels, Canals, Water rights, Water users, Mills, Operation and maintenance.

Plaintiff oats company sued defendant railroad company for money plaintiff spent in operating a millrace that defendant had covenanted to maintain. Plaintiff had sold all its interest in two miles of the race to defendant, without warranty, reserving the right to re-enter if defendant failed to continue the flow of waters in the millrace. Defendant, who ceased to maintain the millrace after its planned use of the land failed when it could not eject other occupants of part of the area, contended that its grant was only an easement which could be abandoned at any time. The Supreme Court of Ohio, in affirming a reversal by a lower appellate court of a directed verdict for defendant, held that the millrace, as a tangible and permanent item, was real property. Therefore, defendant took an interest in land, not an easement, from plaintiff which could be abandoned. (Morris-Florida)
W71-02531

STATE EX REL CRABBE V MIDDLETOWN HYDRAULIC CO (RESERVATION OF DIVERSION RIGHTS).
114 Ohio St 437, 151 NE 653-665 (1926).

Descriptors: *Ohio, *Relative rights, *Diversion, *Land tenure, Contracts, Grants, Water utilization, Canals, Streams, Competing uses, Water rights, Water allocation (Policy), Water contracts, Remedies, Adjudication procedure, Judicial decisions, Legal aspects, Water supply.

In an action of quo warranto against defendant landowner, plaintiff state challenged defendant's diversion of water from a stream which was a feeder of a state-owned canal. Plaintiff alleged that it owned the feeder and that defendant was wrongfully diverting water from it to be used in defendant's manufacturing plant. Defendant claimed that his predecessor in title had reserved such diversion rights for himself, his heirs and assigns when the land surrounding the feeder was sold to the state over one hundred years earlier. Plaintiff argued that the reservation had been made only for the original grantor and that lands occupied by the state were presumed to be owned in fee simple. The Supreme Court of Ohio, noting the evidence of continued possession and use of the water by parties in defendant's chain of title and testimony of various officals that the reservation was continuous, ruled that defendant's diversion was under proper authority. The court further noted that for plaintiff's claimed presumption to operate, the state must actually be in full possession, not merely claim such right while allowing conflicting rights to continue. (Barker-Florida)
W71-02532

ERBSLAND V VECCHIOLLA (JURISDICTION OF CITY TO ENFORCE ZONING ORDINANCE IN NAVIGABLE HARBOR).
313 NYS 2d 576-578 (App Div 1970).

Descriptors: *New York, *Cities, *State jurisdiction, *Navigable waters, Harbors, Reservation doctrine, Boats, Marinas, Boating, Floats, Pontoons, Zoning, Water zoning, Local governments, Legislation, Administrative agencies, Judicial decisions, Legal aspects, Regulation, Supervisory control (Power).

Plaintiff boatyard owner brought action to prohibit defendant building inspector from enforcing the municipality's zoning ordinances with respect to defendant's boatyard. The alleged violation was caused by plaintiff's floats in the harbor. Plaintiff asserted that since the harbor was navigable, his floats were beyond defendant's jurisdiction. Sustaining this contention, the court held that the navigable waters of the harbor were within the sole jurisdiction of the state, precluding defendant from enforcing the ordinance. The lower court's decision for defendant was reversed. (Hart-Florida)
W71-02533

SINCLAIR REFINING CO V KEISTER (LIABILITY FOR POLLUTION OF WATER SUPPLY BY LEAKAGE OF GASOLINE TANK).
64 F2d 537 (6th Cir 1933).

Descriptors: *Water wells, *Gasoline, *Water pollution sources, *Ohio, Storage tanks, Water pollution, Pollutants, Path of pollutants, Pollutant identification, Impaired water quality, Fuels, Oil wastes, Oily water, Wells, Underground, Percolation, Penetration, Permeability, Judicial decisions, Legal aspects.

In an action for damages, plaintiff contended that defendant oil company was liable for maintaining a defective storage tank adjacent to plaintiff's property. Plaintiff contended that leakage of gasoline from the tank percolated into plaintiff's well and polluted her water supply. Defendant contended that gasoline from the tank could not have percolated through the earth and into plaintiff's well. In a per curiam decision, the court held that the question of liability was for the jury and that there was sufficient evidence on the record to support the jury's verdict for plaintiff. (Snow-Florida)
W71-02534

TERRITORY OF HAWAII V GAY (RIGHT TO DIVERT WATERS BY OWNER OF LAND AT RIVER'S SOURCE).
52 F2d 356-359 (9th Cir 1931).

Descriptors: *Hawaii, *Diversion, *Relative rights, *Riparian rights, Irrigation water, Legal aspects, Obstruction to flow, Ownership of beds, Riparian land, Severance, Natural flow doctrine, Diversion dams, Dams, Diversion losses, Water loss, Diversion, Rivers, Flow, River flow, Judicial decisions, Natural flow, Land tenure.

Plaintiff, the territory of Hawaii, brought an action to enjoin defendants from diverting the waters of a river that flowed from its source in the mountains to the sea. Plaintiff contended that it, as a downstream landowner, had certain riparian rights to the flow of the river so as to preclude defendants from damming the river upstream and diverting its waters for irrigation purposes. Defendants, owners of the land at the source of the river, contended that under Hawaiian law and custom the water of a flowing stream belongs to the owner of the land upon which such stream originates. The court held that Hawaiian customary law governed, and thus defendants could divert the waters regardless of the claims of those downstream. The common law with its riparian righrs rules was not applied. The trial court's denial of plaintiff's injunction was affirmed. (Snow-Florida)
W71-02535

UNITED STATES V TUJUNGA WATER AND POWER CO (FORFEITURE OF RIGHTS TO PUBLIC LANDS BY FAILURE TO MEET CONDITIONS OF A GRANT).
48 F2d 689-693 (9th Cir 1931).

Descriptors: *United States, *Public lands, *Easements, *Grants, Reservoirs, Dams, Ditches, Reservoir sites, Drainage systems, Conduits, Channels, Drainage, Irrigation engineering, Federal government, Legislation, Judicial decisions, Right-of-way, Land use, Land tenure, Contracts, Adjudication procedure.

Plaintiff United States brought an action for forefeiture of a grant of an easement on public lands which had been given to defendant canal and ditch company. Plaintiff contended that it had granted to defendant the right to construct ditches and conduit lines upon certain public lands provided that defendant would construct and maintain a dam and reservoir at a given point in the ditch system. Plaintiff contended that defendant had failed to construct the dam and reservoir and that defendant must therefore forfeit its grant of the easement to build conduit lines. Defendant contended that the forefeiture should not be granted since, as a general rule, courts of equity abhor a forfeiture. The court held that the statute authorizing the government to grant rights in public lands also provided for forfeiture of such rights upon the failure of a grantee to meet an agreed upon condition. Defendant's failure to build the dam and reservoir constituted a breach of its agreement and, as such, forfeiture of its rights would result pursuant to the controlling statute notwithstanding traditional rules of equity. (Snow-Florida)
W71-02536

CORBY V RAMSDELL (LIABILITY OF OWNER OF RIVER BED FOR OBSTRUCTIONS TO NAVIGATION).
45 F2d 199-202 (SD NY 1930).

Descriptors: *New York, *Navigable rivers, *Ownership of beds, *Navigation, Ships, Navigable waters, Rivers, River beds, Admiralty, Damages, Barriers, Structures, Beds, Beds under water, Judicial decisions, Hudson River, Docks.

Plaintiff brought an action in admiralty to recover damages for the sinking of his ship. Plaintiff contended that defendant was in possession and control of property under the Hudson River and that defendant had allowed a wharf to decay and become submerged under the water which constituted an unlawful obstruction to the safe navigation of the river. Plaintiff contended that his boat struck upon the wharf and sank. Defendant contended that his predecessor in title had built the wharf and that he had never used it, and therefore he was not responsible for it. The court held that owners of land under navigable water possess rights which are subject to the public's right of navigation. Such owners have an obligation to maintain abutments into the water in such a condition that they do not endanger navigation. This obligation exists by virtue of ownership of the submerged bed and is not dependant upon the actual use of such bed. Defendant was thus held liable for the damages caused by the obstruction which he had knowingly permitted to fall into disrepair. (Snow-Florida)
W71-02537

CITY OF GOLD HILL V CALIFORNIA-OREGON POWER CO (ACQUISITION OF PRESCRIPTIVE RIGHT TO CONSTRUCT DAM).
35 F2d 317-319 (9th Cir 1929).

Descriptors: *Oregon, *Dams, *Easements, *Riparian rights, Obstruction to flow, Relative rights, Diversion structures, Streamflow, Piers, Legal aspects, Remedies, Judicial decisions, Artificial use, Municipal water, Electric power, Hydroelectric plants.

Plaintiff power corporation sought to enjoin defendant city from constructing a wingdam diagonally across the portion of a river of which plaintiff and defendant owned the opposite banks. Plaintiff contended that while defendant had at one time maintained a dam across the river, the dam had long since been washed out and never rebuilt. Plaintiff thus contended that if defendant ever had an easement, it had been abandoned since no dam was ever reconstructed. Defendant contended that it had not abandoned its easement because, while the dam was washed out, a pier which connected the dam with its bank had remained intact for a period after the destruction of the dam. The court held that the evidence sustained a finding that the easement for the dam had been abandoned but that since the statutory period had not yet run as to the pier which remained for a longer period of time, defendant could maintain a structure equivalent in size and diverting capacity to the pier. (Quesada-Florida)
W71-02538

SEWELL V ARUNDEL CORP (TAXPAYERS DO NOT HAVE STANDING TO INTERFERE WITH SUCH WORKS AS CONGRESS HAS AUTHORIZED TO IMPROVE NAVIGABLE WATERS).
20 F2d 503-504 (5th Cir 1927).

Descriptors: *Florida, *Navigable waters, *Supervisory control (Power), *Federal government, Legislation, Local governments, Water policy, Legal aspects, Judicial decisions, Remedies, Permits, Project planning, Public rights, Public lands, Bays, Land forming, Islands, Dredging.

Plaintiff taxpayers sought to enjoin defendant corporation from dredging a shipping channel in Biscayne Bay around which the city of Miami was located. Plaintiffs contended that: (1) according to agreement with the city, the excavation would result in the formation of an artificial island in the bay composed of the dredged materials, and such an island would be an obstruction to navigation; (2) the dredged island would be used by the city for industry and thus destroy the beauty of the bay; and (3) since the grant from the state of Florida to the City of Miami was void because it was not approved by the state legislature, the contract between defendant and the city was void. Defendant contended that its dredging operation was valid since it was conducted pursuant to a permit issued by the Secretary of War as authorized by Congress. The court held that plaintiffs were without standing to sue for the abatement of the nuisance in that it constituted an attempt to interfere with the lawful and ordinary execution of a contract made by authority of Congress. The court also held that while an obstruction in navigable waters is a nuisance which could be abated in a proper proceeding, Congress, having absolute dominion over navigable waters, could authorize such work as it thought necessary to improve such navigable waters. (Quesada-Florida)
W71-02539

WRIGHT V CITY OF RICHMOND (CITY'S LIABILITY FOR FLOODING CAUSED BY INADEQUATE CULVERT).
132 SE 707-709 (Va 1926).

Descriptors: *Virginia, *Culverts, *Flood damage, *Road construction, Natural streams, Roads, Cities, Local governments, Water injury, Rainfall, Cloudbursts, Surface drainage, Surface runoff, Drains, Legal aspects, Judicial decisions, Adjudication procedure, Embankments, Maximum probable flood, Damages, Remedies, Precipitation excess.

Plaintiff homeowner brought action against city for damages to plaintiff's house and property allegedly caused by defendant's negligent construction of a culvert behind plaintiff's property. Plaintiff admitted that the culvert was adequate for the normal flow of water but contended that it was insufficient to take care of the heavy rainfall usually occurring during summer, thereby causing water to back up

and flood plaintiff's property. Defendant contended that plaintiff had released it of all claims arising out of the construction and that plaintiff had failed to notify the city of the claim within six months of the first flooding. Reversing a judgment sustaining defendant's demurrer, the court held that plaintiff's release could only apply to the ordinary consequences of the construction, assuming that defendant did the work in an ordinary and reasonable manner, and did not intend to relieve defendant of its negligence. The court noted that plaintiff's delay in filing his claim would only bar recovery for the first flooding but not for subsequent flooding, notice of which was given promptly. (Liptak-Florida)
W71-02540

BLANKENSHIP V DOWTIN (ENFORCEMENT OF EASEMENT IN WATER SUPPLY ON NEIGHBORING PROPERTY).
133 SE 199-202 (1926).

Descriptors: *North Carolina, *Water supply, *Water rights, *Easements, Groundwater, Pipelines, Preferences (Water rights), Land tenure, Real property, Legal aspects, Judicial decisions, Relative rights, Water contracts, Water utilization, Domestic water, Potable water, Springs, Spring waters, Pumps, Hydraulic equipment, Remedies.

Plaintiff bought a lot at a public auction and also received the right to use the water from a spring and water pump located on his grantor's adjacent lot. Defendant later bought the grantor's lot subject to plaintiff's water rights but disconnected the pump and the water pipes, therby cutting off plaintiff's sole water supply. Plaintiff brought suit and contended that he had a valid easement in the water supply. Reversing the trial court's judgment sustaining defendant's motion for nonsuit, the court held that the only reasonable interpretation of all the circumstances, including defendant's presence at the auction where the land was expressly represented as including the rights to water supply, was that plaintiff had a valid easement in the water supply and that defendant, who bought with notice of those rights, could not disconnect the system or interfere with its use. (Liptak-Florida)
W71-02541

CITY OF PORTSMOUTH V WEISS CITY'S LIABILITY FOR FLOOD DAMAGE CAUSED BY DAM WASHOUT).
133 SE 781-787 (Va 1926).

Descriptors: *Virginia, *Flood damage, *Dam failure, *Cities, Water injury, Damages, Dams, Washouts, Rainfall, Rain water, Surface drainage, Surface waters, Surface runoff, Canals, Drains, Legal aspects, Judicial decisions, Riddance (Legal aspects), Drainage water, Adjudication procedure, Local governments, Legislation, Dam construction, Remedies.

Plaintiff landowner brought an action for damages against defendant city for flood damage to plaintiff's crop of bulbs. Defendant maintained a dam on an abandoned canal and during heavy rainstorms two adjacent canals overflowed, washing out the dam and flooding plaintiff's property. Defendant demurred, contending that plaintiff failed to give the required statutory notice of claim within 30 days of the damage. Plaintiff contended that the notice statute was unconstitutional and that, in any event, the statute did not apply to cases of strict liability but only to claims based on negligence. The court upheld the validity of the statute but noted that it did not apply since defendant, under its authority to maintain the canal, did not have authority to maintain a dam, and plaintiff could recover without showing negligence. The court stated that cities have no right to collect surface water and divert of discharge it to the damage of another's property. However, the court reversed a judgment for plaintiff on procedural grounds, the trial judge having erred in not granting defendant's motion for a bill of particulars as to the damages claimed. (Liptak-Florida)
W71-02542

HARRIS MOTOR CO V PULASKI FURNITURE CO (LIABILITY FOR DAMAGE CAUSED BY REPULSION OF SURFACE WATER BY CONSTRUCTION OF BUILDING).
144 SE 414-417 (Va 1928).

Descriptors: *Virginia, *Surface runoff, *Repulsion (Legal aspects), *Buildings, Surface drainage, Surface waters, Drainage effects, Drainage water, Topography, Riddance (Legal aspects), Drains, Damages, Water injury, Construction, Legal aspects, Judicial decisions, Reasonable use, Relative rights.

Plaintiff and defendant owned adjoining lots on which each constructed a building. Defendant's building obstructed the natural drainage of surface water from plaintiff's property. Plaintiff brought action for damages to his building caused by the resulting accumulation of surface water on his property. Plaintiff admitted that surface water is a common enemy but contended that defendant was unreasonable and negligent in exercising his rights. Affirming the trial court's judgment sustaining defendant's demurrer, the court held that plaintiff's evidence failed to show that defendant had acted in a careless or unreasonable manner since defendant had not altered the natural grade or contour of the property but merely erected a proper building as plaintiff himself had done. (Liptak-Florida)
W71-02543

GEORGIA POWER CO V MOORE (LIABILITY OF POWER COMPANY FOR MAINTAINING NUISANCE).
170 SE 520-525 (Ga 1933).

Descriptors: *Georgia, *Obstruction to flow, *Dams, *Water injury, Barriers, *Riparian rights, Water rights, Judicial decisions, Legal aspects, Dam construction, Flood damage, Dam falure, Earth dams, Public utilities, Hydroelectric power, Backwater, Hydroelectric plants, Dam design, Remedies, Impoundments, Impounded waters.

Defendant power company purchased and repaired a dam. Plant operations were abandoned when a gate feeding the power dam was closed. Subsequently, water backed up the river above the dam, and as a result the creeks and ditches in and below plaintiff upstream landowner's property were filled with mud and sand. The flow of the creeks and ditches was hindered, rendering plaintiff's lands unfit for cultivation. Plaintiff brought a nuisance action, alleging that defendant raised the height of the dam which resulted in the water backup and land damage. Defendant contended that any damage caused by the dam maintenance or construction had been occurring for more than four years prior to institution of the suit and that therefore the suit was barred by the statute of limitations. Defendant further contended that a request to abate, which is a prerequisite to a nuisance suit, was not made. The Court of Appeals of Georgia, in affirming for the trial court's judgment for plaintiff, held that defendant's actions created a fresh nuisance not barred by the statute of limitations. The court stated that a request to abate was not a prerequisite since defendant had knowingly acted to maintain the nuisance. (Powell-Florida)
W71-02544

FRAZIER V LEE (EASEMENTS FOR WATER SUPPLY).
178 SE 722-724 (Ga 1935).

Descriptors: *Georgia, *Easements, *Water rights, *Water supply, Land tenure, Wells, Pipes, Domestic water, Damages, Judicial decisions, Legal aspects, Usufructuary right, Relative rights, Remedies, Adjudication procedure.

Plaintiffs sought an injunction and damages against defendants for interference with plaintiffs' water rights. Plaintiffs obtained their water supply from a windmill located on land adjacent to plaintiffs' which was under control of defendants. Plaintiffs alleged they had a easement in the water which had been obtained for valuable consideration. The grant of water rights had been obtained in a parol agreement with plaintiff wife's father. Plaintiffs alleged that this agreement was a covenant running with the land which would not be interfered with by successors in title. The court reversed the trial court's denial of defendants' demurrer. Plaintiffs' action was against defendants as mere wrongdoers in the commission of acts injurious to water pipes located on the adjacent land and in forbidding plaintiffs to repair the injury, defendants being without interest in the land. However, plaintiffs' alleged right in the property on which the pipes were located on the theory of an easement was not sufficiently evidenced by the allegations, which indicated a personal covenant only, permitting plaintiffs to obtain water but not imposing a burden on the land in the nature of an easement. (Duss-Florida)
W71-02545

RHINES V COMMISSIONERS OF CHATHAM COUNTY (COUNTY'S LIABILITY FOR OVERFLOWING LAND).
179 SE 140-141 (Ga 1935).

Descriptors: *Georgia, *Eminent domain, *Surface drainage, *Remedies, Outlets, Streams, Land tenure, Administrative agencies, Damages, Overflow, Canals, Roads, Drains, Construction, Maintenance, Bridges, Rainfall, Abutments, Legal aspects, Judicial decisions, Local governments, Obstruction to flow, Excessive precipitation.

Plaintiff sought damages from defendant county commissioners, alleging that defendant had appropriated his land for public purposes by defectively constructing a drain which backed up water onto his property. Defendants had constructed a drainage outlet for a creek which allegedly was too small. Heavy rainfall backed water onto plaintiff's land, damaging the land and its buildings. The trial court sustained a demurrer to plaintiff's petition, and the Court of Appeals of Georgia affirmed. The court ruled that plaintiff had failed to state a cause of action. Defendant's acts did not constitute an appropriation of plaintiff's property for public purposes but instead constituted a negligent backing up of water resulting from defective or negligent construction of the improvement. This amounted to an abatable continuing nuisance for which the county was not liable. It is only where property has been damaged by the erection of a public improvement that the owner can recover under the theory that his property was appropriated for public purposes. One judge dissented. (Duss-Florida)
W71-02546

WHITTINGTON V CITY OF BEDFORD (LIABILITY FOR FLOOD DAMAGES CAUSED BY DAM CONSTRUCTION),
210 NW 460-461 (Iowa 1926).

Descriptors: *Iowa, *Dams, *Water levels, *Flood damage, Overlying proprietor, Riparian rights, Rivers, Damages, Judicial decisions, Legal aspects, Riparian land, Relative rights, Competing uses, Diversion, Alteration of flow, Obstruction to flow, Cities, Adjudication procedure, Remedies.

Plaintiff brought suit against defendant city for the erection of a dam downstream from her property which allegedly set back the water of the stream, thereby causing damage to her property by flooding. Defendant conceded at trial that the increase in the height of the water in the river was a technical invasion of plaintiff's rights, but contended that this, without more, would only entitle her to nominal damages. The jury was instructed that any swelling of a stream over its banks by the construction of a dam upon lower real estate is an invasion of the rights of the owner of the upper land who has

the right to the stream in its natural condition. The court found all questions to be merely those of fact for which no disturbance of the lower court's judgment for defendant was necessary. (Barnett-Florida)
W71-02547

KELLOGG V ILLINOIS CENT RR (VALIDITY OF EASEMENTS OVER MORTGAGED LANDS).
213 NW 253-257 (Iowa 1927).

Descriptors: *Iowa, *Railroads, *Easements, *Watercourses (Legal), Judicial decisions, Legal aspects, Bridges, Structures, Crops, Overflow, Right-of-way, Relative rights, Competing uses, Embankments, Damages, Diversion.

Plaintiff brought suit to foreclose a mortgage and to set aside a release and conveyance given by the mortgagor after the execution of the original mortgage. The release gave defendant railroad permission to construct and maintain roads, to divert the flow of water, and to flood the mortgagor's land without liability for damages to crops. This was in addition to defendant's pre-existing easement which allowed maintenance of a bridge and right-of-way across the land. Plaintiff contended that the release executed after execution of the mortgage was inferior to his mortgage claim and that it was an impairment of his security. The Supreme Court of Iowa affirmed a lower court's decision for plaintiff, finding that the grant of the easement to construct and improve the railroad line and to divert the water flow was an impairment of security and thus inferior to plaintiff's equitable lien on the property. (Barnett-Florida)
W71-02548

LYNCH V MINNESOTA POWER AND LIGHT CO (MEASURE OF DAMAGES FOR FLOOD INJURY TO FARMLAND).
219 NW 459-461 (Minn 1928).

Descriptors: *Minnesota, *Damages, *Compensation, *Flooding, Adjudication prodedure, Dams, Flood damage, Saturation, Soaking, Crops, Hay, Crop production, Turf, GRASSES, Depreciation, Judicial decisions, Legal aspects, Water injury.

Plaintiff farm owner sued defendant power company for flood injury to plaintiff's farm. The trial court permitted damages for loss of crops and for permanent injury to plaintiff's sod. Defendant contended that this award resulted in duplication of damages. The court noted that the general rule for crop damages is the value of the crops at the time and place of destruction, in lieu of loss of rental value. The court further determined that if a permanent diminution in land value was caused, then additional compensation should be permitted for this depreciation. Holding that duplication of damages had not occurred, the court affirmed the lower court's decision for plaintiff. (Hart-Florida)
W71-02549

NEKOOSA EDWARDS PAPER CO V RAILROAD COMM'N (AUTHORITY OF STATE TO REGULATE NAVIGABLE STREAMS).
228 NW 144-147 (Wis 1929).

Descriptors: *Wisconsin, *Regulation, *Dam construction, *Navigable waters, State governments, Navigation, Federal government, Streams, Legal aspects, Judicial decisions, Administration, Governments, Legislation, Running waters, Nonnavigable waters, Riparian rights, Public rights, Relative rights, Recreation, Supervisory control (Power), Permits.

Plaintiff appealed an order of defendant Railroad Commission which denied plaintiff a permit to construct a dam in a floatable stream. Plaintiff contended that: (1) the stream was not navigable, (2) it had the right as a riparian owner to build a dam whether the stream was navigable or not, and (3) the state lacked the authority to regulate the use of streams. The Supreme Court of Wisconsin affirmed that trial court's judgment for defendant. A navigable stream is one navigable, such stream continues to be considered as navigable although it is no longer used for commerce. It is the state's duty under the Ordinance of 1787 and subsequent statutes to regulate construction of dams in navigable streams and to keep them free for navigation. (Dye-Florida)
W71-02550

NEKOOSA EDWARDS PAPER CO V RAILROAD COMM'N (RIGHT TO OBSTRUCT NAVIGATION).
229 NW 631-632 (Wis 1930).

Descriptors: *Wisconsin, *Riparian rights, *Administrative agencies, *Relative rights, State governments, Public rights, Navigable waters, Obstruction to flow, Legal aspects, Judicial decisions, Dams, Streams, Running waters, Structures, Navigation, Administration, Legislation, Regulation, Supervisory control (Power).

Plaintiff appealed a judgment affirming denial by defendant Railroad Commission of a permit allowing plaintiff to construct a dam across a navigable stream. Plaintiff contended that as a riparian owner before 1911, when a statute vested defendant with authority to allow or deny such construction, it had a vested property right to obstruct navigation which could not later be taken from it. In affirming the judgment for defendant, the Supreme Court of Wisconsin stated that no right to obstruct navigation vests in a riparian owner until a dam has been lawfully built. (Dye-Florida)
W71-02551

HANNA V OLIVER IRON MINING CO (RIGHT TO MAINTENANCE OF WATER LEVEL OF LAKES).
250 Mich 505, 230 NW 900-902 (1930).

Descriptors: *Michigan, *Lakes, *Water levels, *Cities, Local governments, Water supply, Legal aspects, Judicial decisions, Water level fluctuations, Fluctuation, Reservoir management, Height, Land, Real property, Relative rights, Industries, Water resources, Water table, Water works, Surface waters.

Plaintiff owned land situated on a lake used as a source of water by defendant city. The removal of water for domestic purposes significantly lowered the level of the lake. After the level of the lake had declined, plaintiff platted and subdivided her land. Subsequently defendant city became concerned over the lowered level of the lake and contracted with defendant mining company for the pumping of additional water into the lake. This supplementation of the natural sources of water to the lake caused the water level to rise, rendering several of plaintiff's newly platted lots unfit for habitation. Plaintiff sought to enjoin defendant mining company from pumping further water into the lake, contending that the lake was thereby raised above its natural level. The Supreme Court of Michigan affirmed a judgment for defendants. The water in the lake was raised above its level at the time plaintiff platted her property, but the evidence showed that the water was still below its level before construction of defendant city's waterworks. (Dye-Florida)
W71-02552

HENRY V CHICAGO, B AND O RR (PROXIMATE CAUSE OF FLOOD DAMAGE).
235 NW 394-396 (Wis 1931).

Descriptors: *Wisconsin, *Surface drainage, *Bridges, *Obstruction to flow, Streams, Mississippi River, Drainage, Surface runoff, Railroads, Highways, Judicial decisions, Legal aspects, Floods, Flooding, Land, Real property, Crops, Damages, Streamflow, Corn (Field), Structures, Bridge construction, Flood damage, Water injury.

Plaintiff owned farm lands in a narrow valley. North of plaintiff's land was a highway bridge. A stream flowed under the bridge and into a small ditch on plaintiff's property. Defendant railroad maintained a bridge south of plaintiff's land beneath which the stream passed. In a period of heavy rainfall, plaintiff's lands were flooded, therby damaging his crops. Plaintiff sought damages, contending that the opening beneath defendant's bridge was inadequate to allow free flow of the stream, with the result that water was backed up on plaintiff's property. The Supreme Court of Wisconsin reversed a judgment for plaintiff, finding that the opening under defendant's bridge was of a greater capacity than both the highway bridge and the ditch through plaintiff's property. The railroad bridge was capable of handling all water passing beneath the highway bridge and was thus not the proximate cause of plaintiff's injury. (Dye-Florida)
W71-02553

FLAMBEAU RIVER LUMBER CO V CHIPPEWA AND FLAMBEAU IMPROVEMENT CO (COMPANY AUTHORIZED TO OBSTRUCT RIVER FLOW LIABLE FOR EXCEEDING AUTHORITY).
236 NW 679-684 (Wis 1931).

Descriptors: *Wisconsin, *Reservoir operation, *Water levels, *Obstruction to flow, Lumbering, Impounded waters, Alteration of flow, Judicial decisions, Legal aspects, Discharge (Water), Electric power, Hydraulic structures, Dams, Saw mills, Navigation, Navigable waters, Water rights, Reservoirs, Relative rights, Damages, Administrative agencies.

Defendant improvement company, incorporated to improve navigation and river flow, was authorized by statute to obstruct streams through dam construction. Defendant, by operating certain dams, reduced the water level of a river. Plaintiff lumber company abandoned two log drives and ceased operation because of the reduced water level in the river. Plaintiff brought an action for damages and injunctive relief. Plaintiff, whose financial operations in the twelve years preceding this action included gains and losses, alleged loss of profits because of the abandoned log drives. Defendant argued that it was a state agent and as such was immune from liability. The Supreme Court of Wisconsin held that defendant was liable for wrongful acts in exercising or exceeding authority since it was not performing a governmental function. The court held, however, that damages for plaintiff's lost profits were remote and speculative which precluded recovery. The court reasoned that because of the nature of the logging business, the loss of profits might have been occasioned by other factors. Furthermore, if plaintiff had not abandoned all attempts to drive logs, sufficient water might have been furnished. (Powell-Florida)
W71-02554

ROSEMA V CONSTRUCTION MATERIALS CORP (MOORING RIGHTS OF RIPARIAN OWNER ON NAVIGABLE RIVER).
258 Mich 457, 243 NW 24-25 (1932).

Descriptors: *Michigan, *Navigable waters, *Riparian rights, *Reasonable use, Judicial decisions, Legal aspects, Docks, Water rights, Ships, Rivers, Riparian land, Riparian waters, Remedies, Prescriptive rights, Relative rights.

Plaintiffs owned waterfront property on a navigable river. Defendant corporation constructed a dock on its adjoining waterfront property. Defendant daily docked one of its boats alongside its wharf near plaintiffs' property line so that the boat partially projected out into the water in front of plaintiffs' land. Plaintiffs brought an action for injunctive relief, alleging that defendant had no right to moor its boats continually in front of plaintiffs' property. Plaintiffs expressed fear that defendant might claim prescriptive rights to the use of plaintiffs' waterfront. The Supreme Court of Michigan, in reversing the trial court's judgment for plaintiffs,

held that defendant could moor its boat beside its wharf, even though such mooring over-lapped onto plaintiffs' premises, provided that reasonable access to plaintiffs' land was not obstructed. The court stated that a navigable river is a public highway, navigable in a reasonable way by everyone. The court ruled that defendant could not have acquired a prescriptive right, and therefore plaintiffs' were not entitled to an injunction. (Powell-Florida)
W71-02555

BOARD OF ROAD COMM'RS V MARKLEY (LIABILITY FOR DAMAGES FROM NEGLIGENT DAM CONSTRUCTION).
260 Mich 455, 245 NW 496-498 (1932).

Descriptors: *Michigan, *Dam construction, *Dam failure, *Damages, Construction materials, Dams, Damsites, Dam design, Foundation failure, Washouts, Highways, Culverts, Administrative agencies, Earth materials, Frozen ground, Thawing, Remedies, Costs, Adjudication procedure, Judicial decisions, Legal aspects, Repairing, Dam foundations.

Plaintiff board of commissioners sought to recover damages to a highway caused when defendant's dam collapsed. The dam had been constructed while the earth used for fill was frozen, and when the ground thawed, the pressure of the retained waters caused the collapse. The highway below the dam site was washed out and sections of a concrete culvert were destroyed. The trial court awarded damages to plaintiff. In affirming, the Supreme Court of Michigan ruled that evidence showing the use of frozen earth in dam construction was sufficient to justify a claim of negligent construction proximately causing damage to the highway. The court further held that the measure of damages was a reasonable amount and that evidence of the exact amount spent on repair was admissible in determining such reasonable amount. (Barker-Florida)
W71-02556

CITY OF MADISON V SCHOTT (TITLE TO BED OF NAVIGABLE LAKE).
247 NW 527-530 (Wis 1933).

Descriptors: *Wisconsin, *Ownership of beds, *Navigable waters, *State governments, Governments, Local governments, Cities, Beds under water, Lakes, Meanders, Remedies, Surface waters, State jurisdiction, Adjudication procedure, Judicial decisions, Legal aspects.

In an action to abate alleged nuisances in a lake within the city limits, the city of Madison claimed that title to the lake was held jointly by it and the state in trust for the public. The alleged nuisances consisted of land fill and docks erected by defendants who had no claim of riparian ownership. Defendants claimed that no cause of action was stated since the state was not a party to the suit. The Supreme Court of Wisconsin ruled that title to the bed of the navigable lake was vested in the state in trust for the public, and without the state as a party to such a suit, no action could lie. (Barker-Florida)
W71-02557

WILLIE V MINNESOTA POWER AND LIGHT CO (LIABILITY FOR FLOOD DAMAGE FROM NEGLIGENT DAM OPERATION).
For primary bibliographic entry see Field 04A.
W71-02558

STATE V SWEET LAKE LAND AND OIL CO (TITLE TO NON-NAVIGABLE LAKE).
164 La 240, 113 So 833-839 (1927).

Descriptors: *Louisiana, *Lakes, *Swamps, *Ownership of beds, Legal aspects, Judicial decisions, Remedies, State governments, Legislation, Land reclamation, Marshes, Surface waters, Tidal marshes, Navigation, Non-navigable waters, Navigable waters, Highways, Patents, Beds under water.

Plaintiff state sued to obtain title to the bed of an 1,800-acre lake which was located in the middle of 58,000 acres of land owned by defendant company. Defendant's title derived from three state patents. The patents included the lake area, but plaintiff claimed the lake was navigable when Louisiana became a state and thus was not subject to sale. Alternately, plaintiff argued that if the lake was not navigable, it was acquired by the state under the Swamp Land Grants of 1849 and under an 1855 act could not be sold for less than $1.25 an acre. Defendant claimed the lake was never navigable and that it was sold to defendant's predecessor in title under an 1880 act which allowed sale of the whole area for 12 1/2 cents an acre. The Supreme Court of Louisiana, in affirming a decision for defendant, held the lake was not navigable in 1812. It was surrounded by swampland until defendant's predecessor in title started reclaiming the land and built a canal to the lake. The lake had never been used for commerce, and since it was not susceptible to use for commerce, the lake was not navigable in fact, thus not in law. The court held further that the 1880 act superseded the 1855 act. (Morris-Florida)
W71-02559

COLUMBUS AND GREENVILLE RY V TAYLOR (RIGHT OF RAILROAD TO OBSTRUCT SURFACE DRAINAGE).
115 So 200-201 (Miss 1928).

Descriptors: *Mississippi, *Surface drainage, *Repulsion (Legal aspects), *Obstruction to flow, Riddance (Legal aspects), Surface waters, Surface runoff, Embankments, Drainage, Natural flow, Flow, Flooding, Railroads, Right-of-way, Civil engineering, Engineering structures, Condemnation, Legal aspects, Judicial decisions, Damages, Relative rights.

Plaintiff landowner sued defendant railroad company for damages suffered when the natural surface drainage of his land was blocked by an embankment which was built for defendant's railroad tracks. Defendant contended the jury was improperly instructed that there would be liability regardless of whether the railroad bed was constructed properly or improperly. The Supreme Court of Mississippi, in reversing a lower court verdict for plaintiff, held that the jury was instructed incorrectly. Whenever a railroad acquires a right-of-way for its track by purchase or condemnation, it also obtains exemption from liability to adjacent landowners for damages resulting from proper construction and maintenance of the track bed. A railroad, however, cannot build a track bed so as to obstruct surface waters if another equally convenient and inexpensive method would not so obstruct the natural drainage. The court held that surface waters, subject to that exception, are a common enemy and may be repelled without liability. (Morris-Florida)
W71-02560

MONEY V WOOD (STATE SALE OF LAND UNDER NAVIGABLE WATERS).
118 So 357-360 (Miss 1928).

Descriptors: *Mississippi, *Ownership of beds, *Navigable waters, Legal aspects, Judicial decisions, Remedies, Public rights, State governments, Administrative agencies, Legislation, Shores, Beds under water, Lands, High water mark, Low water mark, Islands, Landfills, Navigation, Real property.

Plaintiff landowner sought an injunction to prevent defendant from erecting an artificial island, with hotels and houses thereon, in the Mississippi Sound in front of plaintiff's home. Defendant contended that he had valid title to the submerged land from the state land commission. The Supreme Court of Mississippi, in affirming the issuance of the injunction, declared that the title allegedly passed by the state was void. The land commissioner acted under a statute allowing sale of state-owned land, but the court ruled that the statute should be construed, if possible, to fit under the constitutional provision forbidding permanent obstruction of navigable waters. The court noted that lands between the high and low tide marks were to be held in trust for the people of the state and not sold for private use, though some states allow such sale. The court further construed the word 'land' to mean dry land rather than land under water so that the statute in question would not authorize the sale. (Morris-Florida)
W71-02561

HAVARD V STATE (RIGHT TO CONTROL OF BEDS UNDER WATER).
124 So 912-914 (Ala 1929).

Descriptors: *Alabama, *Prescriptive rights, *Ownership of beds, *Public rights, Bayous, Beds under water, Legal aspects, Judicial decisions, Remedies, Navigable waters, Bodies of water, Oysters, State governments, Riparian land, Riparian waters, Roads, Shores, Boundaries (Property), Access routes, Adjudication procedure.

Plaintiff, lessee of a landing on a bayou containing oyster beds, brought a trespass after warning action against defendant for use of the landing and water over the oyster beds. Defendant countered that plaintiff did not possess the areas in question, and therefore could not maintain the action. The Court of Appeals of Alabama, in reversing a verdict against defendant, held that the title to the beds and bottoms of all rivers, bayous, lakes and inlets rests in the state in trust for the people. The state could lease oyster beds, but it had not in the instant case, and thus plaintiff had no possessory claim. Since a warning against trespass could not be made for an area larger than the area the person giving the warning possessed, plaintiff's warning was of no effect. The court also indicated that the public had acquired a prescriptive right to use of the public road to the landing, and in such a case the ownership of the shore was subject to the public's right of access to the water's edge. The public had also acquired a prescriptive right to use of the landing. (Morris-Florida)
W71-02562

KILLGORE V COLE (LIABILITY FOR OBSTRUCTION TO FLOW OF STREAM).
126 So 861-862 (Ala 1930).

Descriptors: *Alabama, *Obstruction to flow, *Natural flow, *Riparian rights, Riddance (Legal aspects), Diversion, Remedies, Damages, Drainage, Streams, Surface waters, Dams, Impounded waters, Lakes, Fishing, Damsites, Channels, Flow, Ditches, Rainfall, Water levels, Surface runoff.

Plaintiff upper landowner brought suit to enjoin the maintenance of an alleged private nuisance created by obstruction of the natural flow of water by defendant lower landowner. Plaintiff's and defendant's lands were drained by a stream traversing their properties. Defendant built a dam upon the stream, thereby impounding the waters and creating a lake upon his property. Plaintiff alleged that the dam caused the stream to back up, eddy in the channel and overflow its banks in time of freshets, thereby causing improper drainage of plaintiff's lands. The Supreme Court of Alabama affirmed the lower court's decision for defendant. The court found that by successive lowerings of the dam and spillway, the body of the lake was withdrawn sufficiently, that the flow of water was unobstructed and that no substantial injury resulted to plaintiff as a result of maintenance of the dam. (Barnett-Florida)
W71-02563

CITY OF MOBILE V LARTIGUE (SERVIENT LAND MUST ACCEPT ONLY WATER FLOW-

ING NATURALLY THERETO FROM DOMINENT ESTATE).
127 So 257-261 (Ala 1930).

Descriptors: *Alabama, *Surface drainage, *Surface runoff, *Flow augmentation, Airports, Cities, Surface waters, Natural flow, Natural flow doctrine, Flooding, Floodwater, Ditches, Damages, Judicial decisions, Legal aspects, Topography, Overflow, Drainage, Drainage practices, Discharge (Water), Local governments.

Plaintiff landowner sought damages from defendant city for injury to plaintiff's property which resulted from the increased flow of surface water from defendant's dominant land to plaintiff's servient land. Such increased flow was caused by defendant's improvement of the natural drainage. Defendant contended any injuryresulting was noncompensable as defendant was operating within its governmental capacity. The court ruled that defendant had been operating in its corporate capacity and that defendant would therefore be governed by the same principles that govern private corporations. The servitude of a lower tenement to a dominent tenement, with reference to surface waters, extends only to surface waters flowing in their natural channels, and does not authorize the proprietor of the dominent tenement to collect the water into drains or artificial channels and precipitate it in increased quantity and volume onto the lower land to its injury. The trial court's judgment for plaintiff was affirmed. (Price-Florida)
W71-02564

PEOPLE V FOOTE (STATE OWNERSHIP OF BEDS).
242 App Div 162, 273 NYS 567-582 (1934).

Descriptors: *New York, *Ownership of beds, *Harbors, *State governments, Legal aspects, Judicial decisions, Boundary disputes, Public rights, Patents, Navigable waters, Governments, Reservation doctrine, Political aspects, Beds, Legislation, Real property, Beds under water.

Plaintiff people of New York sought a declaration of their rights to certain beds under a large bay as against defendant landowner. Plaintiff contended that while defendant's heir had established title from the Indians and the Dutch colonialists, his predecessor in title had applied for a confirmatory grant from the English colonial governor and thus divested himself of all title except that specifically identified in the confirmatory grant. Plaintiff thus contended that since the confirmatory grant did not include the beds in question, the beds passed to the colonial government and then to the state of New York. Defendant contended that his heir had established title from the Indians and the Dutch government and that this title had passed to him in an unbroken chain of title. The court held that: (1) a grant from a sovereign is strictly construed against the grantee; (2) a deed from Indians is not a legal source of title; (3) the application by defendant's predecessor for a confirmatory grant from the English colonial government constituted a surrender of all previous title to the government; and (4) the grantee took title only to the lands specifically described in the grant. (Price-Florida)
W71-02565

STATE V JEFFERSON ISLAND SALT MINING CO (DAMAGES FOR TRESPASS ON LAKE BEDS).
183 La 304, 163 So 145-170 (1935).

Descriptors: *Louisiana, *Lake beds, *Ownership of beds, *Mining, Navigable waters, Riparian rights, Leases, High water mark, Water levels, Mineralogy, Salts, Saline lakes, Rivers, Streams, Riparian land, Outlets, Public rights, Damages, Legal aspects, Judicial decisions, Land tenure, Marshes, Appropriation, Adjudication procedure.

Plaintiff state sought damages from defendant salt company for trespass onto state property. Defendant was lessee of land bordering a lake and had mined salt from the bed of the lake. Plaintiff alleged that title to the bed was in the state. Defendant's lessor intervened in the suit and alleged ownership of the bed to the center of the lake. Plaintiff contended that the intervenors were liable with defendant for the trespass. The trial court found for plaintiff, and the Supreme Court of Louisiana affirmed and amended. Disposition of the case depended on: (1) the navigability of the lake; (2) the legal consequences of navigability; (3) the ordinary high water mark of the lake; (4) the extent of the trespass; (5) the quantity of salt removed; (6) the good faith of defendant; and (7) the amount of damages. The court held that the lake was navigable because it was navigable at the time of the Louisiana Purchase. Title to beds of navigable waters is in the state. Ownership of beds extends from the mean high water mark, and the court ruled that the trial court had fixed this mark at too low a level. The court found that defendant's trespass was willful, and stated that the amount of damage for willful trespass of minerals is the value of the minerals taken. Finally, the court held that the lessors and lessee were jointly liable for the trespass. (Duss-Florida)
W71-02566

YOUNG V INTERNATIONAL PAPER CO (LIABILITY FOR DESTRUCTION OF GROWING TIMBER BY FLOODING).
179 La 803, 155 So 231-233 (1934).

Descriptors: *Louisiana, *Industrial water, *Prescriptive rights, *Flooding, Acidic water, Mills, Water pollution sources, Waste water (Pollution), Judicial decisions, Legal aspects, Lumber, Discharge (Water), Floods, Streams, Bayous, Swamps, Water rights, Water injury, Flood damage, Relative rights.

Plaintiff owned land which contained standing timber. However, the land was swampy and generally unfit for agriculture. Defendant operated two paper mills which discharged waste water into a creek. The creek entered a bayou which traversed plaintiff's land. Plaintiff's land was bowl shaped and largely flooded during the spring. Plaintiff brought an action for damages to his land and to his timber which he claimed was killed by defendant's waste water. Plaintiff claimed the land was constantly flooded due to defendant's discharges. Defendant contended that plaintiff had notice of timber damage prior to one year before filing suit and that such knowledge precluded recovery, because of prescription, under Louisiana law. The Supreme Court of Louisiana, in affirming the trial court's judgment for defendant, held that plaintiff's cause of action for destruction of growing timber by flooding had been prescribed. The court also held that plaintiff suffered no damage to his land since it was swampy and unfit for agriculture, and the gas prospects which gave the land chief value was not injured. (Powell-Florida)
W71-02567

LAW V GULF STATES STEEL CO (LIABILITY FOR OBSTRUCTION OF NATURAL FLOW OF EXCESS WATER IN STREAM).
156 So 835-841 (Ala 1934).

Descriptors: *Alabama, *Obstruction to flow, *Rainfall, *Impounded waters, Alteration of flow, Natural flow doctrine, Judicial decisions, Legal aspects, Diversion, Dams, Barriers, Reasonable use, Riparian rights, Rain, Floodwater, Floods, Impoundments, Flood damage, Water injury, Excessive precipitation, Damages.

Defendant corporation owned land abutting on a creek and erected a dam across such creek. Defendant, in connection with the dam, constructed a lateral wall on one side of the creek extending from the dam to a bridge located upstream from the dam. Plaintiff, who owned land upstream from the dam, had his crops destroyed by floodwater as a result of heavy rains. Plaintiff brought an action for damages, alleging that the damming and walling of the creek diverted water onto his land. Defendant contended that unusual and excessive rains which constituted an act of God caused the flooding. The Supreme Court of Alabama reversed the trial court's judgment for defendant. The court held that defendant was liable for obstructing the natural flow of excess water in the creek and causing injury to plaintiff's crops. The court stated that unusual and excessive rainfall was not a correct definition of an act of God. The court pointed out, however, that plaintiff would not have been able to recover if his damages would have occurred had the dam not existed. (Powell-Florida)
W71-02568

HILL V LOLLAR (LIABILITY OF SUBSEQUENT PURCHASERS UNDER WATER RIGHTS CONTRACTS).
157 So 870-872 (Ala 1934).

Descriptors: *Alabama, *Remedies, *Relative rights, *Water supply, Adjudication procedure, Land, Land tenure, Contracts, Artesian wells, Pipes, Water sources, Judicial decisions, Legal aspects, Water contracts.

Plaintiff sought to enjoin defendant from interfering with maintenance of a water pipe by which plaintiff obtained his domestic water supply. Defendant's predecessor had contracted with plaintiff for the installation of the pipe which drew water from an artesian well on defendant's land. Defendant, who had acquired his land through a mortgage foreclosure, claimed ownership as a bona fide purchaser without notice of the prior contract and therefore asserted that he was not bound by it. The trial court granted the injunction, but the Supreme Court of Alabama reversed, stating that if the relative positions of the parties in such an action are to be determined, the positions must be alleged in the original bill and answer. That not having been done, the trial court erred in taking testimony on irrelevant issues. The court further held that defendant's predecessors' agreement with plaintiff was ineffectual against a purchaser such as defendant who acquired title at a foreclosure sale. (Barker-Florida)
W71-02569

WESTERN UNION TEL CO V DAMPSKIBS AKTIESELSKABET MAI (LIABILITY FOR DAMAGE TO UNDERWATER CABLE).
176 La 1081, 147 So 354-357 (1933).

Descriptors: *Louisiana, *Navigation, *Communication, *Damages, Mississippi River, Navigable rivers, Anchors, Ships, Boats, Legislation, Permits, Remedies, Adjudication procedure, Legal aspects, Judicial decisions, Relative rights.

Plaintiff telegraph company brought an action against defendant steamship company for the alleged destruction of plaintiff's cable under the Mississippi River. Plaintiff alleged that defendant's ship had dropped its anchor and that the anchor was dragged, causing it to become entangled in and break the cable. Defendant claimed that its anchor had not been dragged to the position of the cable and therefore did not cause the damage. The trial court rendered a verdict for plaintiff. In reversing, the Supreme Court of Louisiana ruled that the evidence was insufficient to support the verdict. The court further ruled that the right to operate the submarine cable was subject to the paramount right of full, free navigation in the river. It was held that even if defendant's acts were the proximate cause of plaintiff's damages, there would be no liability if defendant was following reasonable navigational practices. (Barker-Florida)
W71-02570

CRESSON V LOUISVILLE AND N RR (LIABILITY FOR COLLECTION AND DISCHARGE OF DRAINAGE WATER IN EXCESSIVE VOLUME).
146 So 462-463 (Miss 1933).

Descriptors: *Mississippi, *Drainage practices, *Flood damage, *Ditches, Railroads, Right-of-way, Drainage effects, Drainage systems, Drainage water, Relative rights, Riparian rights, Drainage, Volume, Excavation, Artificial watercourses, Rainfall, Remedies, Judicial decisions, Adjudication procedure, Legal aspects, Water injury, Overlying proprietor.

Plaintiff landowner brought an action against defendant railroad to recover for flood damage caused by defendant's alleged collection and discharge of excess water onto plaintiff's land. Defendant had created two excavation pits along its right-of-way, and drainage from such pits caused a natural drainage ditch across plaintiff's land to overflow following rainfall. The trial court instructed the jury to return a verdict for defendant. In reversing, the Supreme Court of Mississippi ruled that the question of whether defendant acted wrongfully was determinable by the jury. The court further ruled that even though an upper owner acquires the right of drainage by prescription, such right does not entitle the upper owner to collect surface waters and discharge them in excess of their natural volume upon a lower owner's land. (Barker-Florida)
W71-02571

SEABOARD ALL FLORIDA RY V UNDERHILL (INJUNCTIVE RELIEF FOR FLOODING BY OBSTRUCTION OF NATURAL DRAINAGE).
141 So 306-308 (Fla 1932).

Descriptors: *Florida, *Embankments, *Obstruction to flow, *Flooding, Railroads, Right-of-way, Impounded waters, Drainage, Subsurface waters, Judicial decisions, Legal aspects, Crops, Drainage practices, Access routes, Diversion, Natural flow, Dams, Riddance (Legal aspects), Repulsion (Legal aspects), Damages, Surface runoff.

Defendant railroad constructed an embankment on its right-of-way near plaintiff's land which obstructed the natural drainage of water from plaintiff's lands. Such obstruction impounded the surface waters and caused periodic flooding of plaintiff's lands, thereby rendering them useless for their normal purpose. Plaintiff brought suit to enjoin such impoundment and obstruction. The Supreme Court of Florida affirmed the lower court's order overruling defendant's demurrer. A mandatory injunction was issued against defendant to require it to abate the condition which it created by its embankment so as to no longer obstruct the flow of surface waters. (Barnett-Florida)
W71-02572

BOLINGER V MURRAY (LIABILITY FOR LEVEE WHICH OBSTRUCTED NATURAL FLOW).
137 So 761-764 (La 1931).

Descriptors: *Louisiana, *Levee, *Drainage, *Alteration of flow, Highways, Judicial decisions, Natural flow, Impounded waters, Rainfall, Legal aspects, Relative rights, Bayous, Drainage practices, Ditches, Flow, Administrative agencies, Diversion, Bridges, Administration, Overlying proprietor.

Plaintiff brought suit to have defendants remove a levee which allegedly caused the flooding of his lands. The levee was constructed by defendants to prevent the natural flow of waters from a gravel public highway across their lands. Plaintiff alleged that such levee impeded the natural flow of the water and caused it to be diverted from its natural flow and impounded on his land following heavy rains. Defendants denied the levee obstructed flow and contended that a nearby canal, constructed by a governmental authority, caused the flooding. In affirming the lower court's judgment for plaintiff, the court stated that it was proper to improve one's land but not in such a manner as to cause injury to his neighbor. Water must not be diverted from its natural course and concentrated so as to flow over the adjacent lands of a lower estate where it would not otherwise flow. The court also took notice of the fact that the lower court had found defendants could modify the construction of their levee to prevent such overflow. (Barnett-Florida)
W71-02573

THE M L C NO 10 (STATUTORY REGULATION OF WHARFAGE RATES).
10 F2d 699-705 (2d Cir 1926).

Descriptors: *New York, *Docks, *Rates, *Legislation, Contracts, Beds under water, Bulkhead line, Piers, Claims (Contracts), Judicial decisions, Legal aspects, Admiralty, Ships, Use rates.

Plaintiff wharf owner brought libel to collect wharfage from defendant vessels. Plaintiff's wharves were built upon land under water conveyed to him by the state; the grant implicitly authorized plaintiff to collect wharfage for use by the public. Defendants contended that although the rates plaintiff charged were reasonable, plaintiff could not exact more than the statutory rate fixed by the legislature. Plaintiff asserted that defendants used his wharves knowing his rate, and therefore a binding contract arose by offer and acceptance. The court held that plaintiff was a private wharf owner, and, like all private wharf owners who opened their facilities to the general public, was subject to the wharfage rates established by the legislature. The lower court's decision for plaintiff was reversed. (Hart-Florida)
W71-02574

UNITED STATES V F D GLEASON COAL CO (CRIMINAL PROSECUTION FOR DREDGING NAVIGABLE WATERS WITHOUT APPROVAL).
14 F2d 233-234 (ED Mich 1926).

Descriptors: *Michigan, *Legislation, *United States, *Dredging, Adjudication procedure, Judicial decisions, Legal aspects, Administrative agencies, Federal government, Regulation, Navigation, Alteration of flow.

Plaintiff United States prosecuted defendant coal company for dredging in navigable waters in violation of statute. On motion to quash the indictment, defendant asserted that the statute, which on its face prohibited all dredging without approval of the Secretary of War, only prohibited dredging which would alter the course of the waters. The court observed that Congress clearly intended to prohibit any dredging without approval, and denied defendant's motion. (Hart-Florida)
W71-02575

ANGOLA TRANSFER CO V TEXAS AND P RY (LIABILITY FOR DAMAGES FOR SHIP SUNK BY RAILROAD BRIDGE PROJECTION).
14 F2d 484-488 (ED La 1926).

Descriptors: *Ships, *Piers, *Bridge design, *BRIDGE CONSTRUCTION, Bridges, Administrative agencies, Bulkheads, Piles (Foundations), Railroads, Navigation, Rivers, Damages, Admiralty, Legal aspects, Judicial decisions, Navigable waters.

Plaintiff steamboat owner sued defendant railroad company for damages caused by the sinking of plaintiff's steamboat. Defendant's railroad bridge pier had a steel cap projection extending six inches over the edge of the pier. During a period of high water, this cap was submerged six inches. As plaintiff's vessel passed through the bridge, it struck this projection and sank. Plaintiff asserted that defendant was negligent in maintaining the projection without protection for vessels. Defendant contended that approval of the bridge specifications by the War Department relieved it of liability. Plaintiff pointed out, however, that the plans, which were conditionally approved, included a bulkhead to prevent vessels from striking the pier. This bulkhead was not built. The court observed that vessels have a paramount right to navigate the waterways, concluding that defendant had the burden of providing safe passage for vessels through the bridge. The court determined that an error by the War Department in approving the plans would not relieve defendant from responsibility. Defendant was held negligent in maintaining the projection, and a judgment for plaintiff was entered. (Hart-Florida)
W71-02576

UNITED STATES V PENNSYLVANIA SALT MFG CO (OWNERSHIP OF BED BENEATH DOCK AREA).
16 F2d 476-483 (ED Pa 1926).

Descriptors: *Pennsylvania, *Docks, *Ownership of beds, *Riparian rights, Beds under water, Riparian land, United States, Riparian waters, Navigation, Land tenure, Rates, Low water mark, High water mark, Construction, Bulkheads, Piers, Jetties, Judicial decisions, Legal aspects, Permits, Relative rights.

Plaintiff United States sought an injunction to restrain defendant salt manufacturer from using or charging wharfage for use of a pier. Defendant and plaintiff owned contiguous riparian land. Defendant constructed a pier along the river which extended past the low water mark. Plaintiff constructed a slip along its land, extending it onto defendant's land and into defendant's pier by agreement. Defendant then used the pier and slip, charging wharfage. Plaintiff contended that it owned all the land under the water in the slip, thereby acquiring the exclusive right to use the slip and defendant's wharf. The court found that the dispute involved land both above and below the low water mark. Noting that a riparian owner holds title to land above the low water mark and the state holds title to land below the low water mark, the court observed that the sole right of a non-landowner to land between high and low water marks is for navigation. Such right of navigation is considered a public easement. A riparian owner's construction in navigable waters beyond the low water mark does not thereby give such owner title to the riverbed. A riparian owner may build beyond the low water mark with the state's permission, and such construction is property but not land. Based on these rules, the court held that plaintiff was not entitled to the exclusive right to charge wharfage for use of the pier. (Hart-Florida)
W71-02577

STATE V UNION ELEC LIGHT AND POWER CO (FEDERAL SUPREMACY OVER NAVIGATION AND NAVIGABLE WATERS).
41 F2d 692-699 (CD Mo 1930).

Descriptors: *Missouri, *Dam construction, *Navigation, *Navigable waters, Permits, Dams, Judicial decisions, Legal aspects, Federal government, Federal jurisdiction, State jurisdiction, Eminent domain, Condemnation, Public health, Hydroelectric project licensing, Electric powerplants, Hydroelectric plants, Reservoirs, Submergence, Public lands, Legislation, Administrative agencies, Cities.

Plaintiff state sought to enjoin the construction of a dam by defendant power company. Defendant intended to construct the dam pursuant to authorization by the Federal Water Power Act. Plaintiff contended such construction would: (1) impede navigation; (2) inundate large tracts of public and private land, school districts and highways; (3) create conditions deleterious to public health; and (4) benefit private, not public interests. Defendant contended the dam would aid and benefit navigation. The court stated that Congress has complete jurisdiction over all matters affecting navigation and complete dominion over the navigable waters of the United States under the commerce clause. The court ruled that the dam would aid navigation, that the federal government was supreme in this area, that Congress and not the courts decides on

the necessity for such projects and that the requirements of the Federal Water Power Act had been met. Plaintiff's complaint was dismissed. (Price-Florida)
W71-02578

COHOES POWER AND LIGHT CORP V STATE (CORPORATION'S RIGHT TO CONSTRUCT DAM SUBORDINATE TO STATE'S RIGHT TO IMPROVE NAVIGATION).
128 Misc 130, 217 NYS 839-846 (1926).

Descriptors: *New York, *Reservation doctrine, *Legislation, *Dam construction, State governments, Administration, Judicial decisions, Legal aspects, Water resources development, Dams, Navigable rivers, Navigable waters, Water policy, Prior appropriation, Riparian rights.

Legislation which incorporated plaintiff power corporation and authorized erection of a dam reserved right in defendant state to improve river navigation. Subsequent legislation which authorized plaintiff to erect another dam lacked the river improvement provision. Nineteen years later, defendant state constructed a dam above the dam which plaintiff had erected pursuant to its incorporation act. Defendant also appropriated part of plaintiff's land for canal uses. Plaintiff sought to recover for the value of lands appropriated and for other damages. Plaintiff claimed the destruction of its right to construct another dam pursuant to the second legislation and that the destruction of the right reduced the value of its property. Defendant contended that the reservation in the incorporating act was still in effect and therefore plaintiff had no valid claim except for compensation of lands appropriated. The New York Court of Claims held the legislation authorizing plaintiff to erect another dam was subordinate to defendant's right to improve navigation. The court also stated that failure of plaintiff to construct the authorized dam for nineteen years was sufficient ground for revocation and forfeiture of the right. (Powell-Florida)
W71-02579

EMPIRE STATE RR V STATE (STATE'S RIGHT TO IMPROVE NAVIGABLE STREAM).
133 Misc 6, 231 NYS 36-42 (1928).

Descriptors: *New York, *Navigable rivers, *Water levels, *Flood damage, Damages, Railroads, Navigation, Navigable waters, Dams, Flow, Overflow, Rainfall, Snowmelt, Snow, Precipitation, Administrative agencies, Judicial decisions, Legal aspects, Riparian land, Riparian rights, Channels, Construction, Public benefits, Channel improvement.

Plaintiff railway corporation instituted a claim against the state of New York for money it expended to raise its roadbed along a lake so as to avoid an allegedly higher lake level. Plaintiff alleged that the state had raised the water level of the lake by increasing the height of a dam and retarding the flow of water. The court dismissed the claim. The state has the right to widen, deepen and improve the channel of a navigable stream for the benefit of the public and to facilitate navigation. Riparian ownership is subject to the obligation to suffer the consequences thereof. The state has no liability to injured riparians in the absence of wanton injury, carelessness, negligence or illegality in performance. Defendant's raising of the dam was a part of a general enterprise to improve navigation on the navigable waters in the area. Nothing in the evidence indicated that defendant performed its work negligently or raised the water levels of the lake. The flooding of plaintiff's roadbed was temporary and caused by conditions outside the river channel, namely excess precipitation and accumulated snow. (Duss-Florida)
W71-02580

LITTLE FALLS FIBRE CO V HENRY FORD AND SONS (LIABILITY FOR MAINTAINING FLASHBOARDS FOR PRIVATE BENEFIT ON A FEDERAL DAM).
223 App Div 559, 229 NYS 445-451 (1928).

Descriptors: *New York, *Riparian water loss, *Navigable waters, *Dams, Eminent domain, Canals, Powerplants, Rivers, Water loss, Judicial decisions, Legal aspects, Federal government, Water rights, Water law, Riparian rights, Riparian land, Riparian waters, Public benefits, Competing uses, Relative rights, Remedies.

Plaintiff's manufacturing plants were located on a river branch. Water, impounded by plaintiff's dam across the branch, flowed through a canal to the plants and furnished power. Defendant, licensed by the federal government under the Federal Water Power Act, installed flashboards on a federal dam across the river in connection with its powerplant. Defendant's actions caused a rise in the canal water level and a reduction of plaintiff's water power. Plaintiff brought an action for damages and an injunction. Plaintiff alleged that his property had been taken without just compensation. Defendant claimed that the government authorization was an act in aid of navigation and not subject to judicial review. The court held that plaintiff was entitled to damages and a permanent injunction restraining defendant licensee from maintaining flashboards for private benefit on a federal dam. The court stated, however, that defendant's actions were not a taking of land under navigable waters, to which federal authorities had complete control. The court opined that congressional determination that use is public use is final, but the nature of use, whether public or private, is a judicial question. (Powell-Florida)
W71-02581

VAN CORTLANDT V NEW YORK CENT RR (BRIDGE CONSTRUCTION OVER NAVIGABLE WATERS).
139 Misc 892, 250 NYS 298-315 (1931).

Descriptors: *New York, *Navigation, *Navigable waters, *Bridge construction, Bridges, Railroads, Legislation, Legal aspects, Judicial decisions, Rivers, Dams, Navigable rivers, Non-navigable waters, Public rights, Harbors, Ships, Transportation, Structures, State governments, Adjudication procedure, Bridge design.

Defendant railroad erected a rigid bridge to replace a drawbridge across a river. The river was formerly navigable, but became navigable only by small boats when the state constructed a dam upstream. Plaintiff landowner sought an injunction to force the replacement of the bridge. Plaintiff claimed that the existence of the bridge impeded navigation and decreased the value of his adjacent property. Plaintiff contended that defendant's bridge, which was too low for passage of large vessels, was a public nuisance and violated a statute requiring drawbridges over navigable waters. The court dismissed the complaint. The statute in question required drawbridges only over waters generally navigable in fact. The past existence of commerce on a watercourse does not establish the present navigability in the presence of altered circumstances. The river's navigability by small boats did not establish its navigability for commerce as the term 'navigable waters of the United States' has reference to commerce of a substantial and permanent character. (Dye-Florida)
W71-02582

PEOPLE V BRENNAN (RIGHTS OF PUBLIC IN FORESHORE).
142 Misc 225, 255 NYS 331-336 (1931).

Descriptors: *New York, *Local governments, *High water mark, *Public rights, Low water mark, Recreation, Legal aspects, Judicial decisions, Navigable waters, Fishing, Baits, Water utilization, Sport fishing, Recreation demand.

Appellant fisherman was prosecuted by appellee village for the violation of a village ordinance prohibiting persons from digging bait from the foreshore of the village's beaches without first obtaining a license. Appellant contended that the rights of the public extended to digging bait from the foreshore for use in recreational fishing. Appellee contended that the public's rights were limited to fishing, bathing, and navigation and in no way extended to the digging of bait which had at times resulted in the undermining of the sea walls. The court, in affirming appellant's conviction, held that public rights in the foreshore included only passing, fishing, bathing, hunting and navigation. (Quesada-Florida)
W71-02583

RANSOM V SHAEFFER (TITLE TO LAND BETWEEN HIGH AND LOW WATER MARKS).
153 Misc 199, 274 NYS 570-574 (S Ct 1934).

Descriptors: *New York, *Lakes, *Tidal waters, *Low water mark, High water mark, Tides, Tidal effects, Remedies, Legal aspects, Judicial decisions, Lake Ontario, Lake shores, Water levels, Water level fluctuations, Real property, Contracts, Boundaries (Property).

Plaintiff vendor sought specific performance of a contract for the sale of beach property abutting on a non-tidal lake against defendant vendee. Plaintiff contended that the contract called for the conveyance of his interest in the property and that he conveyed all that he owned. Defendant contended that the contract was void in that he had sought to purchase the land to the low water mark. Defendant contended that plaintiff could only convey to the high water mark because grants of land bounded by tidal waters carry legal title only to the high water mark. Granting an order for specific performance, the court held that Lake Ontario was a non-tidal lake. A grant to land bounded by a non-tidal lake conveys legal title to the low water mark, so plaintiff was able to convey that which he contracted to convey. (Quesada-Florida)
W71-02584

PEOPLE EX REL HUDSON RIVER CONNECTING RR V STATE TAX COMM'N (STATE TAXATION OF BRIDGE OVER NAVIGABLE WATERS).
245 App Div 229, 281 NYS 358-361 (1935).

Descriptors: *New York, *Navigable waters, *Taxes, *Bridges, Ownership of beds, Streambeds, Government supports, Financing, Local governments, State governments, Legal aspects, Judicial decisions, Legislation, Navigation, Non-navigable waters, Assessments, Federal government.

Relator railroad corporation sought to have defendant tax commission's assessment of its bridge reviewed. Relator contended that its bridge was built by authority of Congress and the state was without power to levy a tax upon a franchise from the United States government. Maintaining that the stream which ran under its bridge was non-navigable, relator contended that the bridge was built upon its privately-owned streambed and thus could not be taxed as a special franchise. Defendant contended that Congress' power over navigable waters was limited to matters of navigability and obstruction. Therefore the state could tax such structures because, by granting permission to build the bridge, Congress had waived all prohibitions over the structure. The court held that Congress' power over navigable water was limited to those things necessary to regulate commerce and navigation, and thus the bridge was taxable by the state as a special franchise. The court also found that the stream was navigable, and therefore relator did not own the streambed. (Quesada-Florida)
W71-02585

MASSACHUSETTS V NEW YORK (RESERVATION, IN INTERSTATE TREATY, OF

SOVEREIGNTY TITLE TO LANDS UNDER NAVIGABLE WATERS).
271 US 65, 46 S Ct 357-363 (1926).

Descriptors: *Lake Ontario, *Accretion (Legal aspects), *Ownership of beds, *Boundary disputes, New York, Massachusetts, Lakes, Lake beds, Boundaries (Property), Treaties, Legislation, State governments, Land tenure, Legal aspects, Judicial decisions, Navigable waters, Lake shores, High water mark, Low water mark, Prescriptive rights.

Plaintiff Massachusetts sued defendant New York to quiet title to land formed by accretions to the shoreline of Lake Ontario. By the Treaty of Hartford, New York had granted to Massachusetts private ownership of certain lands bounded by the shore of the lake, but had reserved all rights of sovereignty and jurisdiction. Massachusetts contended that the grant included the lake bed and, alternatively, that the grant included the shore to the low water mark, whereby Massachusetts would be entitled to the accretions. New York argued that ownership of the beds of navigable waters was a right of sovereignty and therefore reserved to New York by the Treaty. New York also argued that Massachusetts owned only to the high water mark and, therefore, was not entitled to the accretion. The United States Supreme Court noted that sovereign dominion over navigable waters can only be divested by express grant, which did not appear in the Treaty, or by prescription, which was precluded by the Treaty and by Massachusetts' acts of acquiescence in New York's sovereignty. The court held that title was in New York. (Liptak-Florida)
W71-02586

MCCORMICK V CHICAGO YACHT CLUB (RIGHT TO NON-RIPARIAN EASEMENT OF VIEW ACROSS PUBLIC PARK).
331 Ill 514, 163 NE 418-421 (1928).

Descriptors: *Illinois, *Riparian rights, *Easements, *Parks, Real property, Land tenure, Riparian land, Riparian waters, Lakes, Lake Michigan, Lake shores, Right-of-way, Access routes, Docks, Boating, Marinas, Recreation facilities, Cities, Local governments, Bulkhead lines, Landfills, Buildings, Legal aspects, Judicial decisions, Adjudication procedure, Remedies.
Identifiers: Injunction (Prohibitory).

Plaintiffs owned land abutting the city's waterfront park. By prior judicial decision, the city held the park in trust for the public and could not erect any buildings thereon without the consent of the abutting landowners. The landowners' rights amounted to easements. The city authorized defendant yacht club to erect a clubhouse and docks on landfill adjacent to the park. Plaintiffs sued to restrain defendant from obstructing their easement of view across the park and access to Lake Michigan. Defendant cross-claimed to quiet title to the landfill and to enjoin plaintiffs from bringing any further actions. The court affirmed the judgment dismissing plaintiffs' complaint, holding that plaintiffs were not riparian owners and had no easements of view or access and that defendant's clubhouse did not violate the public trust since it was not on land within the park's original boundaries. However, the court reversed the judgment quieting defendant's title, stating that equity will not act to remove a mere verbal or oral claim against property since only written instruments on record can be considered as clouds on a title. (Liptak-Florida)
W71-02587

DUPUE ROD AND GUN CLUB V MARLIERE (VALIDITY OF TITLE TO LAKE BED OBTAINED THROUGH SWAMP LANDS ACT).

332 Ill 322, 163 NE 683-685 (1928).

Descriptors: *Illinois, *Lakes, *Swamps, *Ownership of beds, Beds, Lake beds, Navigable waters, Real property, Land tenure, Recreation, Hunting, Sport fishing, Legal aspects, Judicial decisions, Administrative decisions, Ajudication procedure, United States, State governments, Legislation.
Identifiers: *Swamp Lands Act.

Plaintiff hunting and fishing club sued to enjoin defendants from trespassing on club property to hunt and fish. Plaintiff contended that it had acquired part of the land and the bed of a lake from the state of Illinois, which had allegedly obtained the submerged property from the United States pursuant to the Swamp Lands Act. Defendants contended that plaintiff's title was void since the lake was navigable in fact when Illinois was admitted to the Union. Therefore, title passed to the state at that time rather than by the Swamp Lands Act. The court held that the Secretary of the Interior's listing of the lake as swampland under delegated authority from Congress was conclusive except for a direct attack for fraud or mistake. The listing was not open to collateral attack in this trespass proceeding. The court reversed a judgment dismissing that part of plaintiff's claim applicable to the lake bed. (Liptak-Florida)
W71-02588

IN RE PUBLIC BEACH IN CITY OF NEW YORK (TITLE TO AND CONDEMNATION VALUE OF FORESHORE AND OCEAN BOTTOM).

256 NY 156, 176 NE 5 (1931).

Descriptors: *New York, *Low water mark, *Ownership of beds, *Beaches, Atlantic Ocean, Eminent domain, Condemnation, Condemnation value, Compensation, Legal aspects, Judicial decisions, Oceans, Navigable waters, Boundaries (Property), Tidal waters, Shores, Cities.

The City of New York brought eminent domain proceedings to acquire land for a public beach. The city claimed title to the foreshore, the land between the high and low water marks, through a colonial grant of land bounded by the 'main ocean'. The city also claimed that the property owners were only entitled to nominal damages for a taking of the foreshore and the land below the low water mark. The court held per curiam that the city's grant of land to the 'main ocean' only conveyed title to the high water mark and that the property owners were entitled to recover the full value of the foreshore and the land below the low water mark. (Liptak-Florida)
W71-02589

MAYO V NEW YORK CENT RR (OWNERSHIP OF LAND UNDER BAYS).
263 NY 277, 189 NE 217-219 (1934).

Descriptors: *New York, *Bays, *Ownership of beds, *Boundaries (Property), High water mark, Boundary disputes, Grants, Bodies of water, Land, Real property, Oceans, Rivers, Legal aspects, Judicial decisions, Beds, Beds under water, River beds, Channels, Hudson River, Harbors, Navigable waters.

Plaintiff claimed title to land under water in the Hudson River as successor in title to a colonial patent which included land beneath the surface of coves and bays of the river. Defendant railroad contended that the waters beneath which the land lay were not bays and that plaintiff's property stopped at the high water mark. The Court of Appeals of New York affirmed judgments for plaintiff as to parcels of land found to lie in actual bays or coves. Judgment was reversed as to one parcel lying beneath an alleged bay with headlands more than 5 miles apart. Where a true bay is found, its depth and width are many times greater than the distance between headlands. In the instant case, the court found the body of water to be a bend in the river only, with a distance between headlands so great that the receding shore was washed by the tides without hindrance. There was no true sheltered harbor, and the waters were part of the river. (Dye-Florida)
W71-02590

NIAGARA FALLS POWER CO V WATER POWER AND CONTROL COMM'N (POWER OF STATE TO REGULATE DIVERSION OF NAVIGABLE WATERS).
267 NY 265, 196 NE 51-57 (1935).

Descriptors: *New York, *Diversion, *State jurisdiction, *Federal jurisdiction, State governments, Federal government, Administration, Legal aspects, Electric power, Judicial decisions, Rivers, Navigable waters, United States, Electric power production, Dams, Electric power industry, Public utilities, Running waters, Interstate rivers, Navigation, Navigable rivers, River flow, Treaties.

Plaintiff power company sought to avoid a rental charge by defendant state on water drawn from the Niagara River for use in plaintiff's power plant. A federal treaty allowed diversion of up to 20,000 cubic feet per second. A state law allowed diversion of 15,100 cubic feet per second without charge, with a reasonable rental to be charged for diversions exceeding this amount. Plaintiff contended that the federal treaty was binding on the state and that plaintiff was entitled to divert without charge up to the federal limit. The Court of Appeals of New York reversed an order for plaintiff. The federal government's control over navigable interstate waterways is unquestioned, but is exercised in conjunction with the states. The Niagara River, being navigable in part, is navigable as a whole and is thus under the control of the state within the limits set by Congress. The limit on diversion established by treaty did not affect the right of the state to charge a reasonable rental for diversion. Previous grants by the state to plaintiff were always subject to the state's power to regulate. (Dye-Florida)
W71-02591

CLEVELAND, C C AND ST L RY V MUMFORD (CONSTRUCTION OF LEVEES).
197 NE 826-837 (Ind 1935).

Descriptors: *Indiana, *Flood control, *Levees, *Assessments, Costs, Embankments, Rivers, Navigable waters, Navigable rivers, Railroads, Surface waters, State governments, Federal government, Legal aspects, Judicial decisions, Dikes, Flood protection, Bridges, Structures, Construction costs, Damages, Eminent domain, Benefits, Cost allocation.

Defendant railroads and landowners opposed plaintiff commissioners' petition to construct levees. Defendants contended that: (1) a federal act prohibited obstructions in navigable rivers; (2) defendant railroads were damaged by being forced to reconstruct their tracks to conform to the levees; and (3) defendant railroads should not be assessed for construction of levees which were of no benefit to them. The Supreme Court of Indiana reversed a judgment for plaintiff commissioners, finding that defendants' third ground of argument was valid. The federal act prohibiting obstruction of navigable streams did not extend to structures constructed outside the natural course of a stream but within its limits at its highest overflow. Also, railroads are required, as a condition to their franchise, to alter their facilities to conform to new structures by the state. However, for the purpose of assessment, the cost of such alterations is to be subtracted from any benefits accruing to railroads. The case was reversed for new findings as to benefit and assessment. (Dye-Florida)
W71-02592

POWELL V PORTER (PUBLIC NATURE OF ROAD BUILT ALONG BANK OF A NAVIGABLE RIVER).
172 La 681, 135 So 24-26 (1931).

Descriptors: *Roads, *Banks, *Navigable rivers, *Louisiana, Roadbanks, Rivers, Navigable waters, Riparian land, Judicial decisions, Legislation, Relative rights, Legal aspects, Public lands, Public benefits, Riparian waters, Public rights.

Plaintiffs brought a suit to enjoin defendants from using a road which crossed a corner of plaintiffs' land and led to defendants' land. Plaintiffs contended that the road, which ran along the bank of a river transversing the lands involved, was a private road. Defendants contended that the road was a public one in that the road had been used by the public for over 60 years. The court held that the road was a public road. The court based its decision on a statute which provided that all roads constructed on the borders or banks of navigable rivers were to be deemed public roads. The court held that the road in question, having been constructed by plaintiff riparian proprietors along a navigable river, was a public road, and defendants had a right to use such road. (Snow-Florida)
W71-02593

WILLIAMS V GUTHRIE (STATE OWNERSHIP OF BEDS OFF COASTAL WATERS AS REASON FOR DENYING PRIVATE REPLEVIN ACTION FOR RECOVERY OF A PIER).
137 So 682-686 (Fla 1931).

Descriptors: *Florida, *Ownership of beds, *Coasts, *Piers, Beds, Beds under water, Bays, Littoral, Riparian land, Judicial decisions, Docks, Coastal structures, Relative rights, Legal aspects, Shores, Land tenure, Navigable waters, Remedies.

Plaintiff brought action in ejectment against defendant for recovery of possession of a pier. The pier was constructed upon the submerged lands of a coastal bay. Plaintiff contended that he had been deeded the land adjacent to the submerged land and that his ownership of the coastal land extended into the bay and included the submerged land. Defendant, as heir of plaintiff's grantor, contended that the deed of the upland did not include the submerged land, and thus the ownership of the pier never passed to plaintiff. The court held that the state owned the land submerged under navigable waters. The pier was thus an encroachment upon the property right held by the sovereign. A private party could not by ejectment recover possession of such lands under navigable waters, such lands being owned by the state. Plaintiff's action for ejectment was dismissed. (Snow-Florida)
W71-02594

ROUSE V SAUCIER'S HEIRS (NATURE OF STATE'S OWNERSHIP OF TIDAL MARSHES OF NAVIGABLE RIVERS).
146 So 291-292 (Miss 1933).

Descriptors: *Land tenure, *Tidal marshes, *Mississippi, *Ownership of beds, High water mark, Low water mark, Relative rights, Tides, Marshes, Wetlands, Salt marshes, Tidal waters, Rivers, Navigable rivers, Navigable waters, Judicial decisions, Boundaries (Property), Public rights, Legal aspects, Public benefits, Public lands.

Plaintiff brought an action to cancel claims by defendants to certain tidewater lands. Plaintiff contended that he was the owner of certain tidewater marshes between the high water and low water marks of a navigable river. Plaintiff contended that he had received a grant of land adjacent to the river and that such grant extended to the low water mark. Defendants contended that they had been granted these lands under tidewater by a patent from the state of Mississippi. The court held that the state of Mississippi held lands under tidewater as trustee for the public. Such land is held for public purpose, including commerce and navigation, and the state cannot convey such lands to private owners for private purposes. The court thus held that the state of Mississippi could not have granted the lands in dispute to defendants. The court did not establish what interest plaintiff had in the lands, but held that he had sufficient interest to cancel the claims of defendants. (Snow-Florida)
W71-02595

PERKY PROPERTIES INC V FELTON (PRIVATE RIGHTS IN PUBLIC LANDS).
151 So 892-895 (Fla 1934).

Descriptors: *Florida, *Beds under water, *Ownership of beds, *Aquatic life, Relative rights, Littoral, Legislation, Judicial decisions, Oceans, Shores, Coasts, Gulf of Mexico, Aquatic habitats, Riparian land, Navigable waters, Public rights, Land tenure, Tidal waters.

Plaintiff corporation sought an injunction against defendants to protect its rights to propagate sponges in tidal submerged waters on the Gulf Coast of Florida. Plaintiff contended that the legislature had granted to persons owning certain described lands bordering upon the waters of the state the right to grow and propagate sponges in the waters adjacent to the shoreline. Therefore plaintiff contended that defendants were precluded from disturbing such area. Defendants contended that tidal and submerged lands of the state are held in trust for all the people of the state and therefore defendants had the right to be in such area. The court held that the state could grant private rights in such lands for the use of private individuals to grow and propagate sponges, and reversed the trial court's denial of plaintiff's injunction. (Snow-Florida)
W71-02596

LOUISVILLE AND N RR V O'FLYNN (LIABILITY FOR CROP DAMAGE CAUSED BY OVERFLOW OF DRAINAGE DITCHES).
213 Ky 346, 281 SW 174-176 (1926).

Descriptors: *Kentucky, *Ditches, *Drainage water, *Water injury, Flooding, Railroads, Embankments, Drains, Culverts, Surface runoff, Flood damage, Crop response, Surface waters, Contracts, Claims (Contracts), Legal aspects, Judicial decisions, Adjudication procedure, Overflow.

Plaintiff farmer brought action against defendant railroad for damages to his land and crops caused by the overflow of drainage ditches along defendant's roadbed. Plaintiff and defendant had settled a prior similar action and, as part of the settlement, defendant agreed to construct and maintain specified drainage ditches. Plaintiff contended that defendant failed to construct and maintain the ditches in accordance with the prior settlement, resulting in the flooding of plaintiff's land and destruction of his crops. Defendant contended that the ditches were built and maintained as specified, that plaintiff was contributorily negligent and that plaintiff could not recover for his crop losses sinch his action sounded in contract, not in tort. Affirming a judgment for plaintiff, the court held that the evidence and the law were properly submitted to the jury. The court also noted that the issues were clearly presented, even though the action was a mixed contract and tort nature, since plaintiff sought only temporary damages to his crops and not permanent damages to his land. (Liptak-Florida)
W71-02597

PENNSYLVANIA RR V ERIE RR (NAVIGABLE WATER WITHIN BULKHEAD LINES).
40 F2d 420-422 (2d Cir 1930).

Descriptors: *New York, *Navigable waters, *Navigation, *Bulkhead line, Bulkheads, Legal aspects, Judicial decisions, Railroads, Fog, Piers, Floats, Damages, Admiralty, Adjudication procedure, Ships.

Libel was brought by plaintiff railroad company against defendant ferryboat and defendant railroad company for damage done to plaintiff's car float by defendant ferryboat. Defendant ferryboat lost its bearing and rammed plaintiff's float during heavy fog. Plaintiff contended that defendant was at sole fault. Defendant contended that plaintiff was also at fault. The court found that plaintiff's float, the last of six moored at the end of a pier, had a duty to make its presence known during fog. The fact that plaintiff was within the bulkhead line was deemed irrelevant as waters within that line are as open to navigation as any others until occupied by piers. The judgment for plaintiff as modified was affirmed. (Price-Florida)
W71-02598

BEST RENTING CO V CITY OF NEW YORK (TITLE TO LAND UNDER WATER).
221 App Div 707, 225 NYS 66-68 (1927).

Descriptors: *New York, *Land tenure, *Grants, *Boundaries (Property), Boundary disputes, Land, Real property, Low water mark, Adjudication procedure, Legislation, Judicial decisions, Legal aspects, Oceans, Navigable waters, Marshes, Tidal marshes, Tidal waters, Beds under water.

Plaintiff company and defendant city both claimed title to a certain tract of upland and accompanying land under water. Plaintiff claimed title under an early grant. Defendant contended that plaintiff's grant did not prove title to the hassock and ground under water which was north of the upland. The Supreme Court of New York affirmed a judgment for plaintiff. Plaintiff made out its case by producing evidence of a prior acquired title. The burden was then on defendant to prove better title, in this case under a legislative act. Plaintiff's grant of title to the upland, bounded by the low water mark, was held to include hassocks and marshes to the low water mark. (Dye-Florida)
W71-02599

SCHIFFERDECKER V BUSCH (TITLE TO LANDS UNDER WATER).
130 Misc 625, 225 NYS 106-112 (1927).

Descriptors: *New York, *Contracts, *Land tenure, *Ownership of beds, Rivers, Land, Real property, Judicial decisions, Legal aspects, Easements, Right-of-way, Water supply, Hudson River, Beds, Beds under water, River beds, Streambeds.

Plaintiff sought to enforce a contract between himself as vendor and defendant as vendee of a piece of property. Defendant contended that plaintiff had not fulfilled his bargain to convey the property unencumbered since there was a water pipe easement across one lot to supply water to the remaining property and that the deed proffered did not convey the land under water adjacent to the property. The Supreme Court of New York held for plaintiff. The water pipe easement no longer existed since plaintiff owned all the property involved and therefore such rights were merged in him. The owner of upland property owns land under water in the Hudson River, thus plaintiff's conveyance of the upland conveyed the adjacent riverbed. (Dye-Florida)
W71-02600

NEW YORK V ILLINOIS (DIVERSION OF WATER FROM INTERNATIONAL WATERCOURSES).
274 US 488, 47 S Ct 661 (1927).

Descriptors: *New York, *Illinois, *Lake Michigan, *Diversion, Adjudication procedure, Rivers, Navigable rivers, Riparian rights, International waters, Foreign waters, Lakes, Judicial decisions, Legal aspects, Relative rights, State governments, Water supply, Watercourses (Legal).

Plaintiff New York sought an injunction to restrain defendant Illinois from diverting water from Lake Michigan. Defendant moved to strike a paragraph of the complaint which asserted that the diversion might interfere with plaintiff's use of the Niagara and St. Lawrence rivers for power development. The Court noted that the rivers were international,

thereby requiring the consent of Canada and the United States for diversion of such water. Holding that plaintiff's contention did not assert an actual or threatened injury, but only raised an abstract question, the Court sustained defendant's motion. (Hart-Florida)
W71-02601

FOX RIVER PAPER CO V RAILROAD COMM'N (CONSTITUTIONALITY OF STATUTE REQUIRING DAM OWNERS TO CONSENT TO STATE PURCHASE OF DAM).
274 US 651, 47 S Ct 669-671 (1927).

Descriptors: *Wisconsin, *Dams, *Permits, *Riparian rights, Legislation, Administrative agencies, State governments, Administrative decisions, Rivers, Navigable rivers, Beds under water, Navigation, Ownership of beds, Payment, Compensation, Supervisory control (Power), Regulation, Operation and maintenance.

Plaintiff paper company sought a writ of mandamus to compel defendant commission to act upon its application to maintain its dam. Plaintiff maintained its dam without a permit. State statute required dam owners to consent to allow the state to acquire their dams after 30 years for a preformulated amount as a condition to receiving a permit. Plaintiff filed for a permit to maintain its dam, but defendant refused to consider the petition for want of jurisdiction since plaintiff had not filed the consent. Plaintiff asserted that the statute violated the fourteenth amendment as a taking without due process. Plaintiff asserted that under state law the riparian owner held title to the bed of navigable rivers, and therefore it had the right to erect a dam and use water power. Defendant contended that plaintiff's right to use water power was subordinate to the state's control of navigable waters. Finding that plaintiff had no property right under state law to use water power, the court held that the statute was consistent with the fourteenth amendment. The court stated that while a state may give riparians rights over navigable rivers, such rights are subject to the public rights of navigation, fishing and the establishment of a public water supply. (Hart-Florida)
W71-02604

HENRY FORD AND SON, INC V LITTLE FALLS FIBRE CO (LIABILITY FOR LOSS OF WATER HEAD CAUSED BY FLASHBOARDS ON DOWNSTREAM DAM).
280 US 369, 50 S Ct 140-142 (1930).

Descriptors: *Federal Power Act, *Dams, *Hudson River, *Head loss, River, Navigation, Navigable rivers, Legislation, Damages, United States, Federal-state water rights conflicts, Hydroelectric plants, Hydroelectric project licensing, Federal government, Judicial decisions, Legal aspects, Relative rights.

Plaintiff riparian owner sought to enjoin defendant federal licensee from placing flashboards on a federal dam which decreased plaintiff's water head. Defendant was licensed to use surplus water from the federal dam to generate electricity for private use. The flashboards raised the pool two feet, decreasing the head of plaintiff's upriver dam commensurately. Defendant asserted that the federal authority to regulate navigation rendered it immune as a federal agent and that there was no taking of plaintiff's property. Plaintiff asserted that the flashboards were not authorized by the Water Power Act and that their use constituted a fifth amendment taking. Rejecting the contentions of both parties, the Court observed that the Water Power Act provided that licensees should be liable for damages occasioned by licensed projects, and prohibited interference with state law in water appropriation and control. In affirming, the court held that these provisions supported the lower court's award of damages and an injunction to plaintiff. (Hart-Florida)
W71-02612

WISCONSIN V ILLINOIS (INJUNCTION STAYING DIVERSION OF WATER FROM LAKE MICHIGAN).
281 US 179, 50 S Ct 266-268 (1930).

Descriptors: *Illinois, *Lake Michigan, *Sewage, *Diversion, Wisconsin, Missouri, New York, Rivers, Navigable rivers, Navigable waters, Lakes, Riparian rights, Sewage treatment, Water pollution, Alteration of flow, Relative rights, Judicial decisions, Legal aspects, State governments, Water quality.

Plaintiff Wisconsin obtained an injunction against defendant Illinois preventing diversion of water from Lake Michigan for dilution and conveyance of Chicago's sewage. The case was referred to a master to determine the measures and time necessary to effect the decree. In reviewing both parties' exceptions to the master's report, the Court stated that: (1) the rise in Lake Michigan should not have been considered in determining the diversion reduction; (2) the possibility of future congressional action did not affect the prior decree; (3) the Chicago River did not have to be returned to its original direction of flow; and (4) the diverted waters should not be returned to Lake Michigan after purification. Retaining jurisdiction of the dispute, the Court entered a decree in accordance with the master's report, enjoining diversions exceeding stated amounts in such report. (Hart-Florida)
W71-02613

CONNECTICUT V MASSACHUSETTS (STATE'S DIVERSION OF INTERSTATE RIVER FOR MUNICIPAL WATER SUPPLY).
282 US 660, 51 S Ct 286-291 (1931).

Descriptors: *Interstate rivers, *Diversion, *Water utilization, *Reasonable use, State governments, Connecticut, Massachusetts, Natural flow doctrine, Prior appropriation, Relative rights, Riparian rights, Diversion structures, Dams, Reservoirs, Water policy, Water supply, Water rights, Judicial decisions, Legal aspects, Legislation, Domestic water, State jurisdiction, Damages, Water pollution.

Plaintiff Connecticut sued to restrain defendant Massachusetts from diverting water from an interstate river to supply drinking water for the city of Boston. Plaintiff contended that the diversion would interfere with plaintiff's reasonable use, would cause property damage and would interfere with a proposed hydroelectric plant. Plaintiff also contended that the diversion violated the law of riparian use in both states. Defendant contended that the diversion was necessary, reasonable and authorized by the War Department and the Massachusetts legislature. Defendant further argued that the only other source of water for the city was polluted, and its use would be costly and dangerous. The Supreme Court noted that each state has the power to change its law of riparian use and that drinking and other domestic uses of water are of the first importance. The Court held that the advantages resulting from defendant's diversion far outweighed the damages claimed and denied the injunction, but noted that plaintiff could renew its suit should defendant divert more than a reasonable amount of water in the future to plaintiff's substantial damage. (Liptak-Florida)
W71-02614

UNITED STATES V UTAH (STATE VERSUS FEDERAL OWNERSHIP OF BEDS OF NAVIGABLE RIVERS).
283 US 64, 51 S Ct 438-446 (1931).

Descriptors: *United States, *Interstate rivers, *Ownership of beds, *Navigation, Utah, Navigable rivers, Navigable waters, Non-navigable waters, Federal jurisdiction, State jurisdiction, Federal-state water rights conflicts, Colorado River, River beds, Riparian waters, Riparian land, Riparian rights, Legal aspects, Judicial decisions, Boundaries (Property), Public lands, Federal government, Remedies.

Plaintiff United States sued defendant Utah to quiet title to certain river beds in which plaintiff had granted mineral rights to certain parties while defendant had granted those same rights to other parties. Plaintiff contended that the river beds belonged to the federal government since the rivers were non-navigable when Utah was admitted to the Union and introduced evidence showing the paucity of navigation on the rivers at that time and the private rather than public nature of such navigation. Defendant contended that the rivers were navigable at the time of its admission into the Union and that therefore title to the river beds was vested in the state. The Supreme Court noted that the test of navigability was not the extent of actual use of the river for navigation or whether such use was public or private, but the capacity of the river for commercial navigation at that time. The court dismissed plaintiff's petition and held that the rivers in question were navigable in law, if not in fact. (Liptak-Florida)
W71-02616

NEW JERSEY V NEW YORK (INJUNCTION TO PREVENT DIVERSION OF DELAWARE RIVER).
283 US 336, 51 S Ct 478-481 (1931).

Descriptors: *New Jersey, *New York, *Delaware River, *Diversion, Pennsylvania, Alteration of flow, Reasonable use, Navigation, Riparian rights, Navigable waters, Non-navigable waters, Administrative agencies, Administrative decisions, Sewage treatment, Recreation, Fishing, Water pollution, Saline water, Agriculture, Judicial decisions, Legal aspects, Relative rights.

Plaintiff New Jersey sought to enjoin defendant New York from diverting water from the tributaries and watershed of the Delaware River. Plaintiff contended that the diversion would violate the riparian rights of its citizens, asserting impaired navigability, water power, sanitation and recreation. The Court appointed master found that the tributaries affected were non-navigable and that the diversion would not impair the sanitary condition of the river or affect its use for municipal water, industry, agriculture or fishing. However, the master recommended reduction of the diversion to prevent impairment of recreation and recommended installation of a sewage treatment plant. The Court observed that removal of water must be allowed unless substantial harm would result. Although the War Department found no navigational impairment, the court stated that defendant would have to yield to the Department's decision if navigation were later impaired. Affirming the master's report and recommendations, the court limited defendant's diversion to an amount which would not seriously injure plaintiff's rights. (Hart-Florida)
W71-02618

ARIZONA V CALIFORNIA (CONSITUTIONALITY OF BOULDER CANYON PROJECT ACT).
283 US 423, 51 S Ct 522-529 (1931).

Descriptors: *Arizona, *California, *Legislation, *Dam construction, Colorado River, Boulder Canyon Project Act, Prior appropriation, Dams, Colorado River Compact, Interstate compacts, Interstate rivers, Water supply, United States, Competing uses, Project purposes, Water allocation (Policy), Judicial decisions, Legal aspects, Adjudication procedure, Relative rights.

Plaintiff Arizona sought to enjoin defendant California from building a dam on the Colorado River. Plaintiff refused to ratify the Colorado River Compact, approved by Congress in the Boulder Canyon Project Act, which authorized the dam. Plaintiff contended that the Act violated its quasi-sovereign rights. The court noted that Congress could authorize the dam to improve navigation if the river were navigable. Taking judicial notice that the river was navigable, the court held that the Act was not invalid simply because the dam would further purposes other than navigation. Rejecting plaintiff's assertion that the Act prevented plaintiff

from appropriating more water, the court noted that an appropriation is vested, subject only to prior appropriation, and that under Arizona law, a perfected appropriation could only be acquired by physical diversion. The court held that an assumed potential invasion of plaintiff's right to appropriate water was insufficient to declare the Act unconstitutional. Defendant's motion to dismiss was granted. (Hart-Florida)
W71-02619

FLAMBEAU RIVER LUMBER CO V CHIPEWA AND FLAMBEAU IMPROVEMENT CO (DAMS AS OBSTRUCTIONS TO NAVIGATION).
223 NW 417-419 (Wis 1929).

Descriptors: *Wisconsin, *Dams, *Legislation, *Navigation, Lumbering, Access routes, Saw mills, bypasses, Dam construction, Sluices, Administrative agencies, State governments, Navigable rivers, Legal aspects, Judicial decisions, Regulation.

Plaintiff lumber company sought damages and to enjoin defendant dam owner from preventing transport of its logs downriver. Defendant's dams were constructed pursuant to statute, but without the approval of the railroad commission. The statute's purpose was to improve the river's navigability. Plaintiff asserted that the result of the dams was to destroy the navigability of the river. Defendant moved to dismiss the complaint for failure to state a cause of action. From an order sustaining the motion, plaintiff appealed. The court held that the complaint stated a cause of action and that the lower court erred in sustaining the motion to dismiss. (Hart-Florida)
W71-02620

MUNRO V MEILKE (OWNERSHIP OF ISLANDS IN UNMEANDERED NAVIGABLE LAKE).
227 NW 394-396 (Wis 1929).

Descriptors: *Wisconsin, *Land tenure, *Islands, *Ownership of beds, Real property, Legislation, United States, State governments, Reservation doctrine, Lakes, Navigable waters, Navigable rivers, Meanders, Streams, Boundaries (Property), Boundary disputes, Legal aspects, Judicial decisions.

Plaintiff island owner sued to quiet title to islands claimed by defendant, a lessee from the state. The islands were in an unmeandered lake. Plaintiff claimed title through a United States patent which conveyed two 40-acre tracts by governmental description. The islands were located within these tracts. Defendant claimed title through a congressional act which conveyed to the state all unsurveyed islands. Defendant claimed that the islands were part of the navigable lake beds and therefore were state-owned. The court noted that the congressional act passed nothing with respect to the islands since the former patents conveyed whatever title the United States held in them. While agreeing that title to navigable lake beds was in the state, the court noted that the size of islands was immaterial in considering if they were part of the lake bed since islands were not part of the lake bed. The court stated that: (1) a patentee of riparian land takes only to the shore of meandered lakes; (2) all land passes in a patent involving unmeandered lakes; and (3) unmeandered islands within meandered streams pass by patent with adjacent lots when the riparian owner holds title to the thread of the stream. The court affirmed the trial court's ruling that plaintiff owned the islands. (Hart-Florida)
W71-02621

MANNEY V PROUSE (RIGHT OF RIPARIAN OWNERS TO USE OF NON-NAVIGABLE LAKE).
248 Mich 654, 227 NW 685-687 (1929).

Descriptors: *Michigan, *Lakes, *Riparian rights, *Competing uses, Fishing, Boating, Farm ponds, Land use, Reasonable use, Ownership of beds, Relative rights, Remedies, Riparian land, Riparian waters, Usufructuary right, Legal aspects, Judicial decisions, Contracts, Non-navigable waters.

Plaintiff littoral landowner sought an injunction to restrain defendant littoral landowner from trespassing on the lake on which their properties abutted. Plaintiff purchased his tract from defendant, at which time defendant represented that all of the 10-acre, non-navigable lake was within plaintiff's boundaries. In fact, a small portion of the lake was within defendant's boundaries. After the sale, defendant used the lake for eight years before plaintiff brought this suit. Plaintiff asserted that because of the alleged fraud in the sale, defendant should be enjoined from using the lake. The court noted that under state law, defendant had the right to use all the lake providing riparian rights of other owners were not impaired. Rejecting plaintiff's assertion of fraud, the court noted that defendant's ownership of a portion of the lake was obvious to the casual observer, and concluded that actual fraud was highly improbable. Refusing to enjoin defendant from using the lake, the court affirmed the lower court's decision for defendant. (Hart-Florida)
W71-02622

GRANGER V CITY OF CANANDAIGUA (OWNERSHIP OF LAKE BED ACQUIRED THROUGH INTER-STATE TREATY).
257 NY 126, 177 NE 394-396 (1931).

Descriptors: *New York, *Lake beds, *Ownership of beds, *Boundaries (Property), Massachusetts, Navigable waters, Navigation, Riparian waters, Riparian land, Riparian rights, Land tenure, High water mark, Treaties, Legal aspects, State governments, Cities, Judicial decisions, Landfills, Public lands, Public rights, Boundary disputes.

Plaintiff landowner sued to restrain defendant city from filling in a lake for the purpose of building a park thereon. Plaintiff claimed title to the lake bed through the Treaty of Hartford, by which New York granted certain lands to Massachusetts, which in turn granted the lake bed to plaintiff's predecessor. Defendant contended that the lake was navigable and, therefore, New York retained title to the lake bed, the Treaty only passing riparian title to Massachusetts. The court noted that the question of ownership of beds was unsettled in New York, except on a lake-by-lake basis, and that navigability and size were not the only factors to be considered. Since private ownership had not been asserted for over 100 years and since such ownership would deprive other riparian owners of their riparian rights, the court held that title to the lake bed had remained in the state of New York and affirmed the trial court's judgment dismissing plaintiff's complaint. (Liptak-Florida)
W71-02623

HORNE V HOWE LUMBER CO (EFFECT OF ACCRETION ON PROPERTY BOUNDARIES).
190 SW2d 7-12 (Ark 1945).

Descriptors: *Arkansas, *Accretion (Legal aspects), *Avulsion, *Boundaries (Property), Legal aspects, Judicial decisions, Damages, Remedies, Ownership of beds, Navigable waters, Riparian land, Erosion, Federal government, Local governments, State governments, Surveys, Lumber.
Identifiers: *Geodetic surveys.

Plaintiff filed suit to restrain defendant from cutting timber on part of an island. Defendant and intervenors filed a cross-complaint for damages for timber plaintiff had cut, claiming that title plaintiff had allegedly received in a state tax sale was void because the land had been formed by accretion, not avulsion, and thus was in another county. Defendant won the trial court decision, and plaintiff appealed that defendant by statute could not challenge plaintiff's title unless defendant claimed title himself. The Supreme Court of Arkansas, in affirming the decision for defendant, held the statute applied only to sales by county clerks. The court further held that evidence was sufficient to show that the trial court was not erroneous in holding the land formed by accretion. Land which gradually forms by accretion belongs to the owner of the contiguous land to which it joins. The river remains its natural boundary. In avulsion, the watercourse suddenly changes but the property line remains at the old water line, not subject to the river's caprice. (Morris-Florida)
W71-02625

RANSBERRY V BRODHEAD'S FOREST AND STREAM ASS'N (ENTIRE BED OF STREAM CONVEYED BY DEED).

315 Pa 513, 174 A 97-99 (1934).

Descriptors: *Pennsylvania, *Boundary disputes, *Boundaries (Property), *Ownership of beds, Legal aspects, Judicial decisions, Water rights, Streams, Banks, Fishing, riparian rights, Riparian land, Adjudication procedure, Land tenure, Relative rights.

Plaintiff's predecessor in title conveyed by deed a large tract of land including a stream. There was excepted from the deed a small strip of land bordering the stream on the east. The large tract of land came into the possession of defendant forest and stream association. Plaintiff's deed, in describing the boundary of the small strip of land excepted, listed a stone on the east bank of the stream as the place of beginning and a post on the east bank as the end of the description. Plaintiff brought a quiet title action as to the small strip of land. The dispute depended on whether plaintiff's title to the small strip of land extended to the middle of the stream or ran only along the east bank. The Pennsylvania supreme court held that the description in the deed meant that the east bank of the creek was to be the boundary line. The court affirmed the lower court conclusion that the entire bed of the stream had been conveyed in the deed of the larger tract of land. (Powell-Florida)
W71-02634

WOODY V ABRAMS (BOUNDARY DISPUTE WHERE STREAM SUDDENLY SHIFTS COURSE).
169 SE 915-920 (Va 1933).

Descriptors: *Virginia, *Boundary disputes, *Avulsion, *Accretion (Legal aspects), Bank erosion, Boundaries (Property), Erosion, Streams, Watercourses (Legal), Beds, Channels, Land tenure, Banks, Ditches, Dikes, Diversion, Riparian rights, Judicial decisions, Legal aspects, Riparian land.

Plaintiffs brought statutory proceedings to fix the division line between their lands and the land of defendant adjoining landowner. Plaintiffs' and defendant's lands had originally been divided by a line running with a creek. Plaintiffs contended that there had been a sudden change in the course of the creek and that the boundary line remained the old bed of the creek. The jury returned a verdict for plaintiffs, and the Virginia Supreme Court of Appeals affirmed. Erosive accretions attach to the land on which they fall. In such gradual and natural processes the boundary follows the varying course of the stream. However, if for any natural or artificial cause there is avulsion or sudden change in the bed of the stream, the boundary remains the middle of the old channel. There was no reversible error in the jury verdict for plaintiffs. (Duss-Florida)
W71-02639

PUBLIC PROBLEMS AND NON-DECISION MAKING--A STUDY OF THE TUCSON WATER SYSTEM,
Colorado State Univ., Fort Collins. Dept. of Political Science.
John Adrian Straayer.
Natural Resources Journal, Vol 10, No 3, p 545-556, July 1970.

Descriptors: *Water supply, *Water management, Water pollution, Groundwater.
Identifiers: *Decision-costs, Water bank, Regulated monopoly.

This paper considers the failure of political systems in Tucson, Arizona to produce a comprehensive program directed toward eliminating the water supply problem. The source of the problem can be found in rapid population growth and diminishing water sources. Water management in Tucson is highly decentralized with water available to anyone who sinks a well anywhere in the basin. The lack of organization of the water system has generated conflict among public and private organizations involved in water use. The failure to solve the water problem is attributed to several factors. First, political boundaries do not match problem boundaries. Secondly, federal funds have been slow in coming with the result that Tucson has had to shoulder the decision-costs alone. Third, a change in state legislation is necessary if indiscriminate water drilling is to cease. The conclusion for Tucson is that the public policy designed to improve the environment tends to be formed only in response to known problems as perceived by decision makers who have already invested resources in a crisis. (Siegenthaler-Rutgers)
W71-02644

CITY OF SCOTTSVILLE V HEWITT (COVENANT TO PROVIDE WATER NOT EXTINGUISHED BY ACT OF GOD).

234 Ky 656, 28 SW2d 984-986 (1930).

Descriptors: *Kentucky, *Water sources, *Springs, *Supply contracts, Legal aspects, Judicial decisions, Damages, Remedies, Cities, Local governments, Municipal water, Water supply, Water conveyance, Water levels, Spring waters, Farms, Pumping, Water resources, Subsurface waters.

Plaintiff farmer sued defendant city for breach of a covenant to supply his farm with water via a water trough from a spring on land which plaintiff sold to defendant. The agreement was part of the consideration for the sale, but defendant argued that the covenant to install a water trough did not mean it also had to supply water and, secondly, that an act of God, which lowered the water supply, extinguished the obligation. Defendant had installed the trough and a replacement, but the water level of the spring decreased enough to make it inoperative. The Court of Appeals of Kentucky, in affirming a verdict for plaintiff, held the language of the covenant necessarily implied that defendant would supply water. The court also held that an absolute undertaking is not discharged by an act of God making performance more difficult. Plaintiff was awarded damages and an injunction requiring defendant to provide water. (Morris-Florida)
W71-02659

GOVERNMENTAL COOPERATION IN RECREATION AND FLOOD PLAIN DEVELOPMENT,
Virginia Outdoor Recreation Commission.
For primary bibliographic entry see Field 06F.
W71-02662

UNITED STATES V DOUGHTON (MEANING OF NAVIGABLE WATERWAYS UNDER THE COMMERCE CLAUSE).

62 F2d 936-940 (4th Cir 1933).

Descriptors: *Navigable waters, *Non-navigable waters, *Federal jurisdiction, *Inland waterways, Navigation, Streams, Federal government, Legal aspects, United States, North Carolina, State jurisdiction, Judicial decisions, Boats, Transportation, Lumbering, Bridges, Engineering structures.

Plaintiff federal government sought to enjoin the highway commission of North Carolina from maintaining a bridge across a creek. The creek had been dredged and made a part of an inland waterway constructed by plaintiff. Plaintiff contended that the creek was a navigable stream subject to the plenary federal power over navigation under the commerce clause. Plaintiff contended that the bridge was an obstruction to the new waterway. Defendant contended that the stream was not a navigable waterway within the purview of the commerce clause. The Circuit Court of Appeals, Fourth Circuit held that for a stream to be within the regulatory power of Congress as navigable water of the United States, it must be susceptible in its natural condition of becoming a highway of commerce. The mere fact that the stream had occasionally been used by small boats and for floatage of logs did not establish a susceptibility of becoming a highway of commerce, especially in light of the smallness of the creek. The creek was non-navigable and not subject to federal regulation. The injunction was denied. (Snow-Florida)
W71-02668

NEW LOOK IN CONSERVATION BRINGS NEW HOPE FOR ENVIRONMENTAL QUALITY,
For primary bibliographic entry see Field 06G.
W71-02669

CLARK V PIGEON IMPROVEMENT SLIDE AND BOOM CO (FREE AND OPEN COMMERCE OF CANADA-UNITED STATES BOUNDARY STREAMS REQUIRED BY TREATY).
52 F2d 551-557 (8th Cir 1931).

Descriptors: *Treaties, *Streams, *Minnesota, *Lumbering, Obstruction to flow, Foreign trade, Foreign waters, Stream flow, Judicial decisions, United States, Barriers, Floating, International law, International waters, Interstate rivers, Relative rights.

Plaintiff, a Canadian citizen, brought an action for an injunction to stop defendant from obstructing the floatage of logs down a stream. Plaintiff contended that the stream, being a boundary stream between Canada and the United States pursuant to the Webster-Ashburton Treaty, was to be open and free for trade and travel under the terms of the treaty. Defendant, a corporation authorzed by Minnesota legislation to tax floatage of logs upon the stream, contended that its obstruction to the stream was a permissible means of collecting its tolls. The court held that the treaty establishing the Canadian border was superior to Minnesota legislation, and thus the provision in the treaty establishing border streams as free and open to commerce was to govern. Defendant was thus enjoined from imposing any tax upon the floatage of logs and was enjoined from further hindering the floatage of logs down the stream. (Snow-Florida)
W71-02675

PEARCE V SCOTT (OBSTRUCTION OF NATURAL FLOW OF DRAINAGE FROM DOMINANT LAND).
29 F2d 630-631 (DC Cir 1928).

Descriptors: *District of Columbia, *Obstruction to flow, *Natural flow doctrine, *Repulsion (Legal aspects), Relative rights, Barriers, Legal aspects, Remedies, Damages, Judicial decisions, Surface waters, Riddance (Legal aspects), Drainage water, Snowmelt, Surface drainage, Runoff, Rain water.

Plaintiff upper landowner sought to enjoin defendant lower landowner from maintaining a road which ran along the boundary of the two adjoining tracts of land. The road obstructed the natural flow of surface water from plaintiff's land and caused the waters to collect on his land. Plaintiff contended that an upper landowner had a right to the unobstructed flow of surface water from his land. Defendant contended that a lower landowner could lawfully obstruct the natural flow of surface water from higher property. The United States Court of Appeals for the District of Columbia held that the common law rule, which grants the right to obstruct surface waters to lower landowners, applied. Therefore, the injunction against defendant would not issue. (Quesada-Florida)
W71-02684

CANE CREEK COAL MINING CO V BRADEN (DAMAGES CAUSED BY COAL COMPANY'S IMPEDING FLOW OF STREAM).
144 So 143-145 (Ct App Ala 1932).

Descriptors: *Alabama, *Obstruction to flow, *Floods, *Coal mine wastes, Overflow, Water pollution, Damages, Flow, Streams, Rainfall, Flood damage, Watercourses (Legal), Wastes, Industrial wastes, Water pollution sources, Legal aspects, Judicial decisions, Adjudication procedure.

Plaintiff landowner brought suit to recover damages from defendant coal company. Plaintiff alleged that defendant had clogged a stream with debris, thereby obstructing the flow so that during heavy rainfall the stream overflowed plaintiff's land and damaged his crops. Defendant contended that another coal company had washed debris into the stream and that there was concurrent liability for plaintiff's damage. Therefore, plaintiff had the burden of proving what portion of the damage was allocable to each operation. The Court of Appeals of Alabama, affirming a lower court verdict for plaintiff, held that there was sufficient evidence of concert of action, and it was for the jury to fix the damage done by defendant. Also, the trial court properly refused instruct the jury that heavy rainfall was a basis for ignoring defendant's clogging of the stream. Finally, non-expert witnesses were qualified to testify as to the clogged condition of the stream. (Duss-Florida)
W71-02686

6F. Nonstructural Alternatives

FLOOD PLAIN INFORMATION, ROCKY AND WOLF CREEKS, MACON AND BIBB COUNTY, GEORGIA.
Corps of Engineers, Savannah, Ga.
For primary bibliographic entry see Field 04A.
W71-02214

FLOOD PLAIN INFORMATION, CITY OF ALEXANDRIA AND ARLINGTON COUNTY, VIRGINIA, FOURMILE RUN.
Corps of Engineers, Baltimore, Maryland.
For primary bibliographic entry see Field 04A.
W71-02285

THE EFFECTIVENESS OF FLOOD CONTROL STRUCTURES OF THE LOWER MINNESOTA RIVER WATERSHED DISTRICT.
Lower Minnesota River Watershed District, Burnsville.
For primary bibliographic entry see Field 04A.
W71-02312

FLOOD PLAIN INFORMATION, FLOOD HAZARD REPORT OF 4-7 JULY 1969 FLOOD, BLACK RIVER, OHIO.
Corps of Engineers, Buffalo, N.Y.
For primary bibliographic entry see Field 04A.
W71-02447

FLOOD PLAIN INFORMATION, DESTIN COASTAL AREA, OKALOOSA COUNTY, FLORIDA.
Corps of Engineers, Mobile, Ala.
For primary bibliographic entry see Field 04A.
W71-02453

FLOOD PLAIN INFORMATION, YAKIMA-UNION GAP, WASHINGTON.
Corps of Engineers, Seattle, Wash.
For primary bibliographic entry see Field 04A.
W71-02456

FLOOD PLAIN INFORMATION, LITTLE WEKIVA RIVER, SEMINOLE COUNTY, FLORIDA.
Corps of Engineers, Jacksonville, Fla.
For primary bibliographic entry see Field 04A.
W71-02457

REGIONAL PLANNING AND FLOOD PLAIN MANAGEMENT,
Pennsylvania State Planning Board, Harrisburg.
For primary bibliographic entry see Field 06B.
W71-02640

A RECURSIVE PROGRAMING FOR NONSTRUCTURAL FLOOD DAMAGE CONTROL,
Arizona Univ., Tucson.
For primary bibliographic entry see Field 06A.
W71-02646

OPPORTUNITIES AND RESPONSIBILITIES OF LOCAL GOVERNMENT,
Urban Renewal Board, Waterloo, Iowa.
George W. Griebenow.
In: Flood Damage Abatement--Federal Assistance to Local Government, Water Resources Research Center, Virginia Polytechnic Institute and State University, Blacksburg, Virginia, p 1-17, July 1970.

Descriptors: *Flood control, Flood damage, Urban renewal, Urbanization.
Identifiers: *Flood plain management, *Flood plain information, Metropolitan areas.

The city of Waterloo, Iowa suffered severe flooding in the 1960's because of its location at the confluence of 5 rivers. The great damage stimulated civil leaders to seek flood control planning by initiating a program with the Department of Housing and Urban Development. Flood control programs included raising bridges, river dredging and land fill, constructing an industrial part, purchasing land, and securing cooperation from various civil groups. Parks were recommended for low areas because flood damage would be inexpensive. Close work with the Army Corps of Engineers was vital to flood control planning. (See also W71-00002) (Wray-Chicago)
W71-02650

LAND USE MANAGEMENT AN ECONOMIC NECESSITY,
Kentucky Univ., Lexington.
L. Douglas James.
In: Flood Damage Abatement, Federal Assistance to Local Government, Water Resources Research Center, Virginia Polytechnic Institute and State University, Blacksburg, Virginia, p 18-32, July 1970. 1 ref.

Descriptors: *Flood control, Water management.
Identifiers: *Flood plain management.

Land use management should emphasize the best rather than the least use of flood plains. Excessive restriction of flood plain development can hamper the long-term economic growth of any community. Excessive development can lead to a flood damage epidemic. Structural measures are engineering works used to control flood damages on the community level. Nonstructural measures are employed by individuals to reduce damage to their own property. Flood control alternatives must be considered for engineering feasibility, economic feasibility, financial feasibility, social feasibility, and political feasibility. It is unwise for a community to manage flood plain land use by relying entirely on individuals planning the use of their own land to meet their own best needs. The most effective management program is the one where the community uses the management decisions of the property owners to the fullest extent. New federal policy seeks to motivate communities to require individuals to employ nonstructural measures by making free structural measures contingent on an active nonstructural program. The flood proofing decision must consider the range of available methods and the cost and reduction in average annual damages associated with each one. An active and informed land use management program can make a major contribution toward the economic growth of communities containing substantial areas in flood plains. (See also W71-00002) (Wray-Chicago)
W71-02651

FLOOD PLAIN INFORMATION REPORTS,
Corps of Engineers, Washington, D.C.
George R. Phippen.
In: Flood Damage Abatement, Federal Assistance to Local Government, Water Resources Research Center, Virginia Polytechnic Institute and State University, Blacksburg, Virginia, p 33-38, July 1970.

Descriptors: *Flood control, Planning, Federal government.
Identifiers: *Flood plain management, *Flood plain information.

The Army Corps of Engineers' Flood Plain Management Services Program provides the basic flood information, interpretations, technical services, and guidance, with encouragement to the non-federal section which will enable it to plan for appropriate use of flood plains. The Federal Plain Information Report gives information on floods and flood areas, including graphical presentations and photographs. Two types of flood probability are called the Intermediate Regional Flood and the Standard Project Flood. The information in the report is used to identify the flood plain and to show the depths of flooding which may occur. This is helpful in forming zoning restrictions, subdivision regulations, and building codes. (See also W71-00002) (Wray-Chicago)
W71-02652

ENGINEERING DATA FOR SOUND LAND USE PLANNING,
Corps of Engineers, Washington, D.C.
John R. Philpott.
In: Flood Damage Abatement, Federal Assistance to Local Government, Water Resources Research Center, Virginia Polytechnic Institute and State University, Blacksburg, Virginia, p 39-44, July 1970.

Descriptors: *Flood control, Future planning.
Identifiers: *Flood plain information, *Flood plain management.

The purpose of the flood plain information report is to provide specific and detailed knowledge of the flood situation at desired locations. It is possible to determine to a reasonable degree of accuracy, the average return interval of a particular flood height or flow rate at various locations for floods up to the size of about the 100-year flood. After the average flood expectancy is figured, decisions must be made on the use of the flood plains. The Corps of Engineers and the Weather Bureau cooperate in estimating the flood potential of streams. They can also determine the waterway area available at any elevation, or in the case of a known flood height and rate of flow, they can measure the depth of flow by inspection, and compute the velocity of the flow. The conventional approach to flood problems is constructing dams or levees; these structures often do not prevent all flooding, especially in downstream areas. Developers are often lured to downstream areas believing them to be flood-safe. The data available for preventing developments in hazardous areas is available through the Corps of Engineers, TVA, U.S. Geological Survey, U.S. Weather Bureau and other organizations. (See also W71-00002) (Wray-Chicago)
W71-02653

FLOOD PLAIN INFORMATION STUDIES APPLIED TO LOCAL CONDITIONS,
Henrico County, Va.
William W. Fleming.
In: Flood Damage Abatement, Federal Assistance to Local Government, Water Resources Research Center, Virginia Polytechnic Institute and State University, Blacksburg, Virginia, p 45-52, July 1970.

Descriptors: *Flood control, Future planning.
Identifiers: *Flood plain information, *Flood plain management.

Effective flood plain planning usually requires flood plain zoning, technical personnel to establish design standards and criteria, and a working relationship with the U.S. Army Corps of Engineers. A serious problem in developing design standards and flood control is delineating the flood plain contours on major watersheds. When the probable flood lines are established by the Corps, zoning must be comprehensive. In any rapidly expanding urban area, drainage problems, unless properly controlled, will increase proportionally to the density of development. Zoning must be enforced to prevent developments in flood prone areas. (See also W71-00002) (Wray-Chicago)
W71-02654

OPEN SPACE PROGRAM, LAND USE MANAGEMENT,
Department of Housing and Urban Development, Washington, D.C.
Stanley Glowacki.
In: Flood Damage Abatement, Federal Assistance to Local Government, Water Resources Research Center, Virginia Polytechnic Institute and State University, Blacksburg, Virginia, p 53-64, July 1970.

Descriptors: Urban renewal, Community development.
Identifiers: *Open space, Metropolitan areas.

The Department of Housing and Urban Development provides a 50% grant program to metropolitan regions seeking to develop open space areas in flood control management. The current effort is to turn the program toward the intercity, and low-income areas. Although 50% grants are offered for land acquisition only 12 1/2% of the acquisition cost is allowed for development (except in low income areas). The intent of HUD is to put the money where the people are, where the great masses of people can enjoy open spaces created with HUD money. Land that is acquired by a community with HUD aid must remain in open use forever. The only way such land is taken out of open space use is through release by HUD and replacement with land of equal fair market value elsewhere within the community. Applicants for HUD funds wait less than six months to know if they will receive assistance. Two independent appraisals are required for each application. (See also W71-00002) (Wray-Chicago)
W71-02655

OPEN SPACE PROGRAM OPPORTUNITY IN LAND MANAGEMENT,
National Capital Park and Planning Commission, Washington, D.C.
Frank Rubini.
In: Flood Damage Abatement, Federal Assistance to Local Government, Water Resources Research Center, Virginia Polytechnic Institute and State University, Blacksburg, Virginia, p 65-67, July 1970.

Descriptors: *Flood control, Conservation.
Identifiers: *Flood plain information, *Flood plain management, Open space.

Large population growth and ensuing land developments in narrow stream valleys contribute to high velocity runoff and unmanageable accumulations of storm waters. Water retention structures and land treatment measures are methods of dealing with this problem. In Maryland and Washington, D.C. recreation development is restricted to no more than one-third of a given land parcel, with the

balance for passive or conservation use. Largely grassed or wooded, these areas serve as effective aquifer sponges, and contribute to the reduction of runoff velocity. (See also W71-00002) (Wray-Chicago)
W71-02656

COMPREHENSIVE FLOOD PLAIN DEVELOPMENT WITH TVA,
Tennessee Valley Authority, Knoxville.
John W. Weathers.
In: Flood Damage Abatement, Federal Assistance to Local Government, Water Resources Research Center, Virginia Polytechnic Institute and State University, Blacksburg, Virginia, p 68-71, July 1970.

Descriptors: *Flood control.
Identifiers: *Flood plain information, *Flood plain management.

The Tennessee Valley Authority initiated its flood plain management assistance (local flood relations) program in 1953 with a fixed formula for solving flood problems. TVA would supply basic flood data to a community which would then exercise its police power through zoning ordinances, subdivision regulations, and building codes to control uses of flood hazard areas. The data is supplied only when requested by the local community and sent to the designated state agency for endorsement. The community must show its intent to use the information and the state agency must pledge its assistance. Wide distribution of the report and counseling with prospective developers of flood plain lands often result in adjustments to the flood problem. Local planning commissions proceed with flood plain regulations when the data is documented. TVA and state personnel assist the planning commission in presenting the recommendations to the governing body. TVA also responds to requests for appraisals of flood problems associated with industries, subdivisions, utilities, roads and streets. (See also W71-00002) (Wray-Chicago)
W71-02657

A CASE IN POINT,
Coeburn, Va.
W. C. Lambert.
In: Flood Damage Abatement, Federal Assistance to Local Government, Water Resources Research Center, Virginia Polytechnic Institute and State University, Blacksburg, Virginia, p 72-74, July 1970.

Descriptors: *Flood control, Community development.
Identifiers: *Flood plain management, *Flood plain information.

After the town of Coeburn, Virginia suffered severe flooding in 1963, the town council appointed a flood study commission to cooperate with TVA in the development of a comprehensive flood damage prevention plan. A feasibility study and subcommittees were set up. The resulting flood control project also stimulated industrial development and beautification project. Suggested improvements for TVA's program include having property appraisals done by federal and local agencies and acquiring more adjacent land for recreational uses. (See also W71-00002) (Wray-Chicago)
W71-02658

FAIRFAX COUNTY COOPERATES,
Fairfax County, Va.
Carl W. Porter.
In: Flood Damage Abatement, Federal Assistance to Local Government, Water Resources Research Center, Virginia Polytechnic Institute and State University, Blacksburg, Virginia, p 87-94, July 1970. 1 map.

Descriptors: *Flood control, Management, Planning.
Identifiers: *Flood plain management, *Flood plain information.

In the rapidly expanding urban area of Fairfax County, Virginia, the natural forest cover was removed and serious flooding occured more frequently. Private studies analyzed the flood hydrology of the streams, established the flood plain levels, and included master plans for improvements to protect those areas already developed and exposed to worsening periodic flooding. When the plans were completed and the referendum held, the citizens voted it down. The County then entered into a pilot study project with the U.S. Geological Survey. Both the county and the Geological Survey were enthusiastically hopeful that it would enable such a fast developing urbanizing area to plan ahead. An order of priorities was established secheduled to give first priorities where most of the new development was taking place. Because of skyrocketing land values, the county employed private surveyors to establish monumental base lines to good second-order survey accuracy in addition to the Geological Survey maps. Sections of the building code and zoning restrictions are listed. (See also W71-00002) (Wray-Chicago)
W71-02660

FLOOD PLAIN MANAGEMENT IN WISCONSIN,
Wisconsin Dept. of Natural Resources, Madison. Flood Plain and Shoreland Management Section.
Thomas M. Lee.
In: Flood Damage Abatement--Federal Assistance to Local Government, Water Resources Research Center, Virginia Polytechnic Institute and State University, July 1970, p 95-108. 2 fig.

Descriptors: *Flood control, Management, Planning.
Identifiers: *Flood plain management, *Flood plain information, Comprehensive planning.

In 1966 Wisconsin legislature provided for joint local-state action for flood damage abatement. Local units of government are required to enact, administer and enforce reasonable and effective flood plain zoning ordinances. State responsibilities include establishing and upgrading minimum standards for flood plain regulations, surveillance, and coordinating flood plain management with programs of other federal, state, local and private organizations. Flood plain management standards reflect the necessity of providing for the needs of nature and man. First the stream channel and floodway are retained, usually to be used for agriculture, recreation, or parking. Next, flood protection is provided for areas outside the floodway but still subject to inundation by flood waters. When community development plans provide for significant use of the flood plain, it is necessary to determine the changer in flood heights which will be caused by future developments. State standards govern these developments. The Corps of Engineers flood plain management services program has been most effective in assisting communities in flood plain delineation. One of the most important aspects in tailoring flood plain regulations to local needs is the selection or determination of the floodway. Ten hydraulic factors that influence the selection of the floodway are listed. Success of Wisconsins flood plain management program depends on thorough public understanding, local support, and enforcement of land use regulations. (See also W71-00002) (Wray-Chicago)
W71-02661

GOVERNMENTAL COOPERATION IN RECREATION AND FLOOD PLAIN DEVELOPMENT,
Virginia Outdoor Recreation Commission.
Elbert Cox.
In: Flood Damage Abatement--Federal Assistance to Local Government, Virginia Polytechnic Institute and State University, Blacksburg, Virginia, July 1970, p 109-114.

Descriptors: Flood control.
Identifiers: *Flood plain management, *Flood plain information.

The Commission of Outdoor Recreation was conceived to further cooperation and coordination of programs in recreation by different levels of government. Funds are divided between federal government and states on a 60/40 basis. Flood Plains often provide choice sites for park and recreation facilities. The Flood Plain Zoning Act amendment authorizes counties or municipalities to impose zoning on flood plains to give them protection. The Commission will make studies of individual rivers, prepare reports to the General Assembly with specific recommendations for the creation of a scenic river. The development of recreational areas and scenic rivers can contribute materially to flood damage abatement. (See also W71-00002) (Wray-Chicago)
W71-02662

SCS PROGRAMS IN URBAN AND RURAL DEVELOPMENT,
Soil Conservation Service, Beltsville, Md.
John K. Abernathy.
In: Flood Damage Abatement--Federal Assistance to Local Government, Water Resources Research Center, Virginia Polytechnic Institute and State University, Blacksburg, Virginia, July 1970, p 115-121.

Descriptors: *Flood control, *Conservation, Water policy.
Identifiers: *Flood plain management, *Flood plain information, Metropolitan areas, Water resources planning.

The services of the Soil Conservation Service are available in helping solve urban and suburban as well as rural conservation problems. The urban expansion has brought conservation problems to nonfarm lands. The SCS of Virginia had programs involving (a) soil surveys, (b) assistance through conservation districts, (c) assistance to non-farm and urban groups, (d) resource conservation and development projects, (e) preparation of natural resource data, (f) water-resource activities and river-basin investigations, and (g) small watersheds. (See also W71-00002) (Wray-Chicago)
W71-02663

6G. Ecologic Impact of Water Development

NATIONAL ESTUARY STUDY --- VOLUME 1. MAIN REPORT.
Fish and Wildlife Service, Washington, D.C.
For primary bibliographic entry see Field 02L.
W71-02217

NEW LOOK IN CONSERVATION BRINGS NEW HOPE FOR ENVIRONMENTAL QUALITY,
Sydney Howe.
In: Water Spectrum, Vol 2, No 3, Fall 1970, p 2-5.

Descriptors: *Conservation, *Resource development, *Environment, *Political aspects, *Organizations, Federal government, Planning.
Identifiers: *National Environmental Policy Act of 1969, *Council on Environmental Quality, *Confrontation, *San Francisco Bay Conservation and Development Commission, *Conservation Foundation, Corps of Engineers.

In recent years the narrower ethic of the conservation movement which emphasized rural or wilderness preservation has been broadened to encompass the whole environment of man. Rampant technology has with all its blessings, brought unwanted by-products and multiplied the pressures upon basic natural resources, making their conservation more complex. New organizations and new coalitions are adding to the political pressure where decisions regarding environmental quality standards are made. The author reviews coalitions that have formed recently; the expanded 1970 appropriations by congress is traced back to this in-

creased activity. It is contended that there is strength in the diversity of organizations. Governments at all levels are beginning to reflect public impatience with environmental insults. The National Environmental Policy Act of 1969 establishes the Council on Environmental Quality to advise the President and to direct all Federal agencies in recommending legislation. It is suggested that 'healthy confrontation' based on tolerance, education, and give-and-take with unbiased and complete public information will insure effective problem solving. The San Francisco Bay Conservation and Development Commission is cited as an example of such convergence as are efforts by the Conservation Foundation in a number of areas conflicts. Stressed is the need for stricter, more comprehensive analysis of alternatives with conservationists and developers cooperating in finding solutions.
W71-02669

07. RESOURCES DATA

7A. Network Design

WATER RESOURCES DATA FOR COLORADO-1968: PART 2. WATER QUALITY RECORDS.
Geological Survey, Denver, Colo. Water Resources Div.
For primary bibliographic entry see Field 02K.
W71-02470

7B. Data Acquisition

SEDIMENT MEASUREMENT TECHNIQUES: RESERVOIR DEPOSITS,
For primary bibliographic entry see Field 02J.
W71-02205

ABOVE-BOTTOM ACOUSTIC REFLECTIONS, MISSISSIPPI RIVER DELTA,
Louisiana State Univ., Baton Rouge. Coastal Studies Inst.
For primary bibliographic entry see Field 02L.
W71-02211

A CONTRIBUTION TO THE SOLUTION OF GROUNDWATER FLOW PROBLEMS BY MEANS OF PASSIVE ELECTRICAL ANALOGUE MODELS BY DISCRETIZATION OF THE TIME VARIABLE,
Technische Universitaet, Dresden (East Germany).
For primary bibliographic entry see Field 02F.
W71-02261

THE ROCK AND BONG TECHNIQUES OF MEASURING WATER LEVELS IN WELLS,
Missouri Univ., Rolla. Dept. of Geology and Geophysics.
David M. Stewart.
Groundwater, Vol 8, No 6, p 14-18, November-December 1970. 5 p, 1 fig, 2 tab.

Descriptors: *Water levels, *Water wells, *Sounding, *Depth, Measurement, Water measurement, Instrumentation, Surveys, Velocity, Sound waves, Calibrations.
Identifiers: Well water levels, Fall time, Reverberation.

The depth to water in wells can be measured by timing the fall of a marble or BB. Depth to water can also be determined in terms of the frequency of the reverberations heard in a well. Because of their inherent inaccuracies these methods cannot replace the standard methods such as the steel tape or electric sounder. But both have a wide range of useful applications. Considerable time could be saved if an estimate were known before applying a steel tape or electric sounder. The reverberation technique has the distinct advantage of applicability to wells that have no access. The fall technique can be used when falling water makes a steel tape useless and an electric sounder is not available. (Knapp-USGS)
W71-02445

DISTRIBUTION OF PLANKTON IN RELATION TO THE LAYER OF REDUCED TRANSPARENCY (IN RUSSIAN),
Akademiya Nauk SSSR. Institut Okeanologii.
E. A. Lubny-Gertsyk, and V. I. Degtyarev.
Doklady Akademii nauk SSSR, Vol 176, No 2, p 443-445, 1967. 1 fig, 6 ref.

Descriptors: *Sampling, *Pacific Ocean, *Plankton, Analysis, Photosynthesis, Distribution patterns, Photometry, Tropical regions, Nets.
Identifiers: *Transparency, Vertical distribution, Coordinated sampling method.

The relationship between the transparency of water and the vertical distribution of plankton was investigated during the expedition of the ship 'Vityaz' to the tropical zone of the Pacific Ocean. The position of the reduced transparency layer was determined by a light meter of the FPM-60 type. The simultaneous 'coordinating sampling' of plankton in the layer of reduced transparency was done by nets, ocean model DZhOM-80/113. Despite of inaccuracies of analyses, inflicted by ship movement, a general relationship between the plankton density and the position of the reduced transparency layer was observed. The minimum transparency and the maximum density of plankton were confined to an approximate depth of 20 meters. The introduced method of 'coordinated sampling' promises to explain the peculiarities in plankton distribution and the nature of the reduced transparency layers. (Wilde-Wisconsin)
W71-02521

CALCULATION OF PRECIPITABLE WATER,
Weather Bureau, Silver Spring, Md. Techniques Development Lab.
For primary bibliographic entry see Field 02B.
W71-02608

THE REMOTE SENSING OF OIL SLICKS BY RADAR,
Naval Research Lab., Washington, D.C.
For primary bibliographic entry see Field 05A.
W71-02615

A RAPID, NONDESTRUCTIVE TECHNIQUE FOR INFRARED IDENTIFICATION OF CRUDE OILS BY INTERNAL REFLECTION SPECTROMETRY,
For primary bibliographic entry see Field 05A.
W71-02673

FAST-RESPONSE OXYGEN SENSOR TESTED.
For primary bibliographic entry see Field 05A.
W71-02676

MEASUREMENT AND SIGNIFICANCE OF ADENOSINE TRIPHOSPHATE IN ACTIVATED SLUDGE,
Florida Univ., Gainesville. Dept. of Environmental Engineering.
For primary bibliographic entry see Field 05A.
W71-02677

A HAND-OPERATED WINCH FOR BACTERIOLOGICAL WATER SAMPLING,
Hawaii Univ., Honolulu. Dept. of Microbiology.
K. R. Gundersen, R. Ohye, and D. Stroupe.
Journal (of the) Water Pollution Control Federation, Vol 42, No 1, p 131-132, January 1970. 2 fig.

Descriptors: *Sampling, *Mechanical equipment, Water analysis.
Identifiers: *Winch.

A hand-operated winch is described and illustrated. The features of the winch are: (1) simultaneous sampling of several 250-ml water samples at different depths from surface to approximately 150 m can be made, (2) it is attachable to the railing of a small boat, (3) it is easily portable by one man, (4) it is noncorrodible by sea water, and (5) it is inexpensive. (Little-Battelle)
W71-02679

7C. Evaluation, Processing and Publication

ERROR CRITERIA IN WATER SURFACE PROFILE COMPUTATIONS,
Massachusetts Inst. of Tech., Cambridge. Dept. of Civil Engineering.
For primary bibliographic entry see Field 02E.
W71-02201

NUMERICAL SOLUTION OF UNSTEADY FLOWS IN OPEN CHANNELS,
Massachusetts Inst. of Tech., Cambridge. Dept. of Civil Engineering.
For primary bibliographic entry see Field 02E.
W71-02202

IMPLICIT FLOOD ROUTING IN NATURAL CHANNELS,
North Carolina State Univ., Raleigh. Dept. of Civil Engineering; and Virginia Inst. of Marine Science, Gloucester Point.
For primary bibliographic entry see Field 02E.
W71-02207

A COMPUTER PROGRAM FOR THE CALCULATION OF HYDROMETER SIZE ANALYSIS,
University Coll. of North Wales, Bangor. Dept. of Physical Oceanography.
S. Buchan, A. Jones, and P. Simpkin.
Marine Geology, Vol 9, No 4, p M23-M29, November 1970. 7 p, 4 fig, 3 ref.

Descriptors: *Computer programs, *Particle size, *Hydrometers, *Stokes law, *Settling velocity, Suspension, Hydrometry, Suspended load, Sedimentation, Sedimentology, Instrumentation, Sediments.
Identifiers: *Particle size analysis, Algol computer programs.

An ALGOL computer program is presented for the calculation of the results from the hydrometer method of particle size analysis. The program was written to obtain particle diameter, in millimeters and in phi units, the cumulative weight percent finer than the corresponding equivalent particle diameter, and the normalized cumulative weight percent. Stokes' equation is solved using data from a standard hydrometer analysis. The parameters measured are: temperature of the suspension, the corrected hydrometer reading, the elapsed time from the start of the analysis, total oven dry weight of sample, the specific gravity of the solids, the dispersing agent correction, and weight of sediment retained on standard B.S. sieves. (Knapp-USGS)
W71-02215

WATER RESOURCES DATA FOR COLORADO 1969: PART 1. SURFACE WATER RECORDS.
Geological Survey, Denver, Colo. Water Resources Div.

Copies of report available from District Chief, Water Resources Div., US Geological Survey, Denver Federal Center, Denver, Colo, 80225. Geological Survey Duplicated Basic Data Report, 1970. 394 p, 3 ref.

Descriptors: *Surface waters, *Streamflow, *Flow measurement, *Data collections, *Hydrologic data, Gaging station, *Colorado, Flow rates, Average flow, Low flow, Lakes, Reservoir stages.

Identifiers: *Basic data, Stream discharge, Flow extremes.

Surface-water records for the 1969 water year (October 1, 1968 to September 30, 1969) for Colorado, including records of streamflow or reservoir storage at gaging stations, partial-record stations, and miscellaneous sites, are given. Records for a few pertinent gaging stations in bordering States also are included. These data represent that portion of the National Water Data System collected by the U. S. Geological Survey and cooperating State and Federal agencies in Colorado. (Woodard-USGS)
W71-02246

HYDROGEOLOGIC DATA FOR THE SOUTHWESTERN COASTAL RIVER BASINS, CONNECTICUT,
Geological Survey, Hartford, Conn.
For primary bibliographic entry see Field 02E.
W71-02259

CONTROL OF SEA WATER LEVEL IN COASTAL POROUS MEDIA BY MEANS OF DOUBLE PUMPING,
Kyoto Univ. (Japan). Dept. of Civil Engineering.
For primary bibliographic entry see Field 02L.
W71-02265

WATER MOTION IN EARTH STRUCTURES AT VARYING WATER LEVELS IN A REACH,
Akademiya Nauk SSSR, Novosibirsk.
For primary bibliographic entry see Field 02G.
W71-02269

DIRECTORY OF FEDERALLY SUPPORTED INFORMATION ANALYSIS CENTERS.
Federal Council for Science and Technology, Washington, D.C. Committee on Scientific and Technical Information.
For primary bibliographic entry see Field 10.
W71-02310

FOUR-POINT METHOD OF CHARACTERISTICS,
Technische Hogeschool, Delft (Netherlands).
For primary bibliographic entry see Field 08B.
W71-02431

PUBLIC WATER SUPPLIES IN LOUISIANA,
Geological Survey, Baton Rouge, La.
For primary bibliographic entry see Field 03D.
W71-02451

DIGITAL SIMULATION OF THE OGALLALA AQUIFER IN SHERMAN COUNTY, KANSAS,
Kansas State Geological Survey, Colby.
For primary bibliographic entry see Field 02F.
W71-02454

METHODS FOR THE COMPUTATION OF WATER BALANCE OF RESERVOIRS,
State Hydrological Inst., Leningrad (USSR).
Z. A. Vikulina.
In: Symposium on World Water Balance, Vol 2, International Association of Scientific Hydrology Publication No 93, p 295-300, July 1970. 6 p.

Descriptors: *Water balance, *Reservoirs, *Methodology, Data collections, Equations, Hydrologic cycle, Meteorology, Precipitation (Atmospheric), Runoff, Evaporation, Water storage, Spillways, Temperature, Humidity, Wind velocity, Synoptic analysis, Hydrologic budget, International Hydrological Decade.
Identifiers: *Surface inflow, Outflow.

Methods of water balance computations of reservoirs (USSR) from measurements of hydrometeorological parameters are presented. The accuracy of computations, as well as the duration of the design interval are governed by the accuracy of determination of balance components. During the operation of reservoirs, the balances are computed for monthly and yearly intervals. (Woodard-USGS)
W71-02460

PRELIMINARY INVENTORY OF THE WATER RESOURCES OF IDAHO.
Idaho Univ., Moscow. Water Resources Research Inst.

Idaho Water Resource Board Report, 1968. 598 p, 242 fig, 38 map, 52 tab.

Descriptors: *Water resources, *Idaho, Surface waters, Groundwater, Water quality, Streams, Streamflow, Lakes, Runoff, Flow rates, Water yield, Climatology, Reservoirs, Consumptive use, Water control, Water rights, Hydrologic data, Irrigated land, Aquifers, Meteorology, Evaporation, Water balance, Hydrography, Precipitation (Atmospheric), Maps, Bibliographies.
Identifiers: *Idaho Water Resource Board.

Through contracts with various agencies, the Idaho Water Resource Board is engaged in a series of studies that will be used as a basis for supporting Idaho's position in regional and interstate basin investigations, in the development of a State Water Plan, and for informational reports for private or public use. Historical records as well as current conditions are utilized to identify the sources of water, the magnitude of yields and flows, the dependability of the supply, the character of the water, and the extent of water use. The report is organized into chapters on climatology (atmospheric water resources), surface water, groundwater, water use and water control, and water rights. An appendix contains numerous supporting data and a comprehensive bibliography. A very valuable part of the report is the extensive atlas that includes maps showing climatological information, surface water supply information, availability of groundwater to wells, presently irrigated land, locations of decreed water rights, and other hydrologic and water use information. (Woodard-USGS)
W71-02471

08. ENGINEERING WORKS

8A. Structures

REPORT ON FOURMILE RUN FLOODING, ALEXANDRIA, VIRGINIA.
Greeley and Hansen, Chicago, Illinois.

Report to City of Alexandria, Virginia, April 1968. 66 p, 14 fig, 5 tab.

Descriptors: *Flood protection, *Flood control, *Storm runoff, *Urbanization, *Drainage engineering, *Storage, Maximum probable flood, Virginia, Flash floods, Land development, Channel improvement, Flood plains, Construction costs, Planning, Flood plain zoning, Runoff.
Identifiers: *Fourmile Run, Arlington County, Alexandria, Arlandria.

General design criteria are developed along with a basis of design for the construction of engineering works to protect property from flooding along Fourmile Run between the stream's outlet to the Potomac River and the Shirley Highway. Fourmile Run carries stormwater runoff from an 18.5 square mile drainage area in Arlington County. Extensive damage to commercial and residential properties results from flash floods, particularly in the Arlandria area at the North boundary of the City of Alexandria. The data obtained on the maximum flood of record, August 20, 1963, were considered in the study. The recommended basis of design is to provide for a minimum discharge of 20,000 cfs, but, preferably, 24,000 cfs. The construction costs for the latter are estimated at $9,437,000, based on 1968 unit costs. The project would entail: the removal and construction of new culverts, bridges and a railroad trestle which constitute streamflow bottlenecks; provision of storage in the main stem by channel improvement and levee construction; off-channel detention storage on City-owned property located in the flood zone; and miscellaneous provisions, including possible removal of buildings from the flood plain. The Fourmile Run flash flooding problem is a prime example of similar situations in various parts of the country. (Poertner)
W71-02286

UNITED STATES V ARIZONA (CONGRESSIONAL AUTHORIZATION REQUIRED FOR FEDERAL DAM PROJECTS).
For primary bibliographic entry see Field 06E.
W71-02340

WILLIE V MINNESOTA POWER AND LIGHT CO (LIABILITY FOR FLOOD DAMAGE FROM NEGLIGENT DAM OPERATION).
For primary bibliographic entry see Field 04A.
W71-02558

STATE V UNION ELEC LIGHT AND POWER CO (FEDERAL SUPREMACY OVER NAVIGATION AND NAVIGABLE WATERS).
For primary bibliographic entry see Field 06E.
W71-02578

PEOPLE EX REL HUDSON RIVER CONNECTING RR V STATE TAX COMM'N (STATE TAXATION OF BRIDGE OVER NAVIGABLE WATERS).
For primary bibliographic entry see Field 06E.
W71-02585

DESIGNING THE LININGS OF PRESSURE TUNNELS IN ANISOTROPIC ROCK,
Bureau of Reclamation, Denver, Colo.
V. S. Eristov.
Available from NTIS as PB-193 772T, $3.00 in paper copy, $0.95 in microfiche. Translated from: Gidrotekhnicheskoe strortel'stvo, No 3, p 28-31, 1965. Bu Rec Translation No 740, March 1970. 11 p, 3 fig, 4 ref.
Identifiers: *Underground structures, Design, *Rock (Geology), Deformation, Elasticity, Shear stresses, Pressure, Grout, Anisotropy, Structural properties, USSR, Translations, Rock mechanics, *Pressure tunnel linings, *Tunneling (Excavation).

Formulas are derived for the stresses and radial deformation of a pressure tunnel lining in anisotropic rock using the theory of elasticity. The surrounding rock is assumed to be transformed into a monolithic elastic medium by grouting. It is shown that it is possible to consider, with small error, only radial components of deformation and elastic resistance. By using a constant coefficient of elastic resistance, the formulas are transformed into the formulas for an isotropic medium. The deformations obtained by these formulas for a thin lining coincide reasonably close with the corresponding deformations for an opening in an orthotropic medium loaded along the contour with a uniform radial load. An example calculation is given.
W71-02603

HYDRAULIC MODEL STUDIES OF JACKSON LAKE DAM BAFFLE BLOCKS,
Bureau of Reclamation, Denver, Colo. Office of Chief Engineer.
For primary bibliographic entry see Field 08B.
W71-02626

TUNNEL BORING TECHNOLOGY, DISK CUTTER EXPERIMENTS IN SEDIMENTARY AND METAMORPHIC ROCKS,
Bureau of Mines, Washington, D.C.

Roger J. Morrell, William E. Bruce, and David A. Larson.
Available from the NTIS as PB-193 982, $3.00 in paper copy, $0.95 in microfiche. Report of Investigation No 7410, July 1970. 32 p, 12 fig, 6 tab.
Identifiers: *Tunnels, Boring, *Subsurface structures, Excavation, *Rocks, Fragmentation, Cutting machines (Tools), Compressive properties, Rock excavation, Performance, Force, Limestone, Marble.

Disk-cutter experiments were performed on five rock types ranging in compressive strength from 9.000 psi to 27.000 psi. A specially constructed testing machine called a linear-cutter apparatus (LCA) was designed to load and traverse a free-rolling disk cutter across a sawed rock surface. The LCA was instrumented to measure the vertical and horizontal forces acting on the cutter during the run. The ability of disk cutters to fragment rock was determined for both 60-degree and 90-degree cutting-edge angles, and relationships and regression equations were developed to predict cutter performance based on rock physical properties and applied forces.
W71-02627

8B. Hydraulics

ERROR CRITERIA IN WATER SURFACE PROFILE COMPUTATIONS,
Massachusetts Inst. of Tech., Cambridge. Dept. of Civil Engineering.
For primary bibliographic entry see Field 02E.
W71-02201

NUMERICAL SOLUTION OF UNSTEADY FLOWS IN OPEN CHANNELS,
Massachusetts Inst. of Tech., Cambridge. Dept. of Civil Engineering.
For primary bibliographic entry see Field 02E.
W71-02202

PHOTOMICROSCOPIC SUBLAYER VELOCITY MEASUREMENT,
Illinois Univ., Urbana. Dept. of Civil Engineering; and Waterways Experiment Station, Vicksburg, Miss.
Harry G. Wenzel, Jr., and Michael J. Mathews.
ASCE Proceedings, Journal of the Hydraulics Division, Vol 96, No HY12, Paper 7724, p 2467-2480, December 1970. 14 p, 8 fig, 1 tab, 16 ref, append.
OWRR Project A-026-ILL.

Descriptors: *Open channel flow, *Boundary layers, *Turbulent flow, *Current meters, *Photography, Cameras, Tracers, Tracking techniques, Model studies, Viscosity, Turbulence, Velocity, Microscopy.
Identifiers: *Boundary layer flow, *Boundary layer photography.

The measurement of velocity in the boundary layer region of open channel flow can be a difficult problem using probes. A microscope can be used to observe the motion of small tracer particles and yield quantitative velocity data without disturbing the flow. Micron particles were photographed through a microscope as they passed through the focal field oriented parallel to the channel bottom. Particle velocity data was used to compute a mean velocity profile, turbulence intensity and skewness of the particle velocity distribution. Errors can arise in the computation of mean velocity and turbulence intensity. These errors are analyzed quantitatively. (Knapp-USGS)
W71-02206

MOTION OF SINGLE PARTICLES IN ALLUVIAL CHANNELS,
Geological Survey, Fort Collins, Colo.
For primary bibliographic entry see Field 02J.
W71-02208

EFFECTS OF PROPOSED BARRIERS ON HURRICAN SURGE HEIGHTS - REPORT 1 OF GALVESTON BAY HURRICANE SURGE STUDY,
Army Engineer Waterways Experiment Station, Vicksburg, Miss.
N. J. Brogdon.
Army Corps of Engineers Waterways Experiment Station Technical Report H-69-12 (No 1 of 3 Reports), September 1969. 167 p, 5 fig, 118 plate, 6 tab.

Descriptors: *Barriers, *Hurricanes, *Surges, *Bays, *Texas, *Flood protection, Gulf of Mexico, Model studies, Tides, Salinity, Distribution patterns, Structures, Navigation, Inland waterways, Discharge (Water), Flooding, Hydraulic models, Model studies, Flood control.
Identifiers: *Galveston Bay (Tex).

Design of barriers for protection of all or portions of Galveston Bay against inundation by hurricane surges required the use of hydraulic model studies of the Galveston Bay complex to verify the results of surge routings by analytical methods and to determine the effects of all proposed structures on normal tides and hurricane surge heights upstream and downstream from barrier sites. The model reproduced the coast from Freeport on the south to High Island on Bolivar Peninsula on the east and included an average width of the Gulf of Mexico of about 25 miles, measured normal to the gulf. Hurricane surges were reproduced by a horizontal-displacement type surge generator. Either of the two major hurricane protection plans tested would provide protection for the area inland from the barrier when the navigation openings were closed. The Alpha plan, located on the coastline of the Gulf of Mexico, would provide protection for a greater area since it shelters practically the entire area inland from the coastline. The Gamma plan leaves unprotected a major portion of West Bay, the entire city of Galveston, and all of East Bay. The Texas City, LaMarque-Hitchcock system, when completed, will provide protection for these towns from surges of 15 ft msl. (See also W71-02244 and W71-02245). (Woodard-USGS)
W71-02243

EFFECTS OF PROPOSED BARRIERS ON TIDES, CURRENTS, SALINITIES, AND DYE DISPERSION FOR NORMAL TIDE CONDITIONS - REPORT 2 OF GALVESTON BAY HURRICANE SURGE STUDY,
Army Engineer Waterways Experiment Station, Vicksburg, Miss.
W. H. Bobb, and R. A. Boland, Jr.
Army Corps of Engineers Waterways Experiment Station Technical Report H-69-12 (No 2 of 3 Reports), July 1970. 140 p, 2 fig, 73 plate, 9 photo, 12 tab.

Descriptors: *Barriers, *Hurricanes, *Surges, *Bays, *Texas, *Flood protection, Gulf of Mexico, Model studies, Tides, Salinity, Distribution patterns, Structures, Navigation, Discharge (Water), Flooding, Hydraulic models, Model studies, Flood control.
Identifiers: *Galveston Bay (Tex).

Migration from cities to suburban areas combined with industrial growth justifies hurricane protection for the Galveston Bay area. Models indicated two barrier schemes would protect upstream areas. Alpha barrier was located just behind the gulf beaches and Gamma barrier crossed Galveston Bay 9 miles upstream. Both schemes provided gated navigation openings across channels and gated tidal passages of sufficient capacity, located to maintain existing conditions with respect to tides, currents, salinities, and dispersion patterns. Diversion of Trinity River flow to Houston, which would increase fresh water to Buffalo Bayou and decrease fresh water to Trinity Bay, is proposed. A power station will pump up to 3500 cfs of cooling water from Houston Ship Channel and Tabbs Bay via Cedar Bayou to the plant and discharge into Trinity Bay. Tests for normal tides were made in a 1:600-, 1:60-scale model. Important conclusions were: (a) diversions from Trinity River to Houston will have no significant effects; (b) Cedar Bayou Power Station will transport water which is more saline and of poorer quality from Houston Ship Channel and Tabbs Bay to upper Trinity Bay; (c) plan 1 Alpha barrier would have no significant effects on tides, currents, salinities, or dye dispersion patterns and the area of tidal passages could be reduced 20% without adversely affecting navigation; and (d) plan 1 Gamma barrier would cause slight reductions in tidal prism and salinities. (See also W71-02243 and W71-02245). (Woodard-USGS)
W71-02244

EFFECTS OF PLAN 2 ALPHA AND PLAN 2 GAMMA BARRIERS ON TIDES, CURRENTS, SALINITIES, AND DYE DISPERSION FOR NORMAL TIDE CONDITIONS - REPORT 3 OF GALVESTON BAY HURRICANE SURGE STUDY,
Army Engineer Waterways Experiment Station, Vicksburg, Miss.
W. H. Bobb, and R. A. Boland, Jr.
Army Corps of Engineers Waterways Experiment Station Technical Report H-69-12 (No 3 of 3 Reports), July 1970. 106 p, 61 plate, 7 photo, 10 tab.

Descriptors: *Barriers, *Hurricanes, *Surges, *Bays, *Texas, *Flood protection, Gulf of Mexico, Model studies, Tides, Salinity, Distribution patterns, Structures, Navigation, Fishing, Recreation facilities, Discharge (Water), Flooding, Hydraulic models, Model studies, Flood control.
Identifiers: *Galveston Bay (Tex).

Hurricane protection barriers are proposed for the Galveston Bay area. A separate model indicated that two barrier schemes would protect upstream areas: the plan 2 Alpha barrier was located just behind the gulf beaches and the plan 2 Gamma barrier crossed Galveston Bay 9 miles upstream. Both schemes provide gated navigation openings across channels and gated tidal passages of sufficient capacity, located to maintain existing conditions with respect to tides, currents, salinities, and dispersion patterns. Gated tidal passages are expensive and should be held to a minimum. Tests for normal tides were made in a 1:600-, 1:60-scale model for pre- and post-barrier conditions, and tides, currents, salinities, and dispersion patterns were observed. Important conclusions were: (a) the plan 2 Alpha barrier would have no significant effects on tides, currents, salinities, or dye dispersion patterns; (b) maximum current velocities in the navigation opening of the plan 2 Alpha barrier would be about 5.2 fps for normal tide; (c) the plan 2 Gamma barrier would cause slight reductions in the tidal prism and salinities upstream of the barrier. (See also W71-02243 and W71-02244). (Woodard-USGS)
W71-02245

VELOCITY AND SURFACE SLOPE RELATIONSHIPS IN UNSTEADY LAMINAR FLOW,
Cincinnati Univ., Ohio. Dept. of Civil Engineering.
Louis M. Laushey.
French summary. In: Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 4 (Subject D), Science Council of Japan, Kyoto, p 441-449, 1969. 9 p, 7 fig, 1 tab, 2 ref.

Descriptors: *Groundwater movement, *Unsteady flow, *Laminar flow, Slopes, Velocity, Water table, Darcys law, Mathematical studies, Equations, Flow characteristics, Viscosity, Density, Aquifer characteristics, Permeability.
Identifiers: Darcy law modification.

The Darcy law of proportionality of water table slope and velocity is shown to be incorrect for unsteady laminar flow. When the water surface is falling, the horizontal flow velocity will be greater than that predicted by the product of the permeability and the instantaneous surface slope. An equation is proposed for the velocity if the water surface is falling. The cosine of the slope angle of the path

of surface particles is a significant slope needed to correct the Darcy law for unsteady laminar flow. (Woodard-USGS)
W71-02263

MATHEMATICAL MODELS OF GROUNDWATER FLOW,
Technische Universitaet, Dresden (East Germany).
For primary bibliographic entry see Field 02F.
W71-02264

THE STUDY OF COLLECTOR WELLS BY MEANS OF VISCOUS FLOW ANALOGY,
Technical Univ. of Istanbul (Turkey). Dept. of Hydraulics and Water Power.
Kazim Cecen, Eren Omay, and Aydeniz Siginer.
French resume. In: Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 4 (Subject D), Science Council of Japan, Kyoto, p 367-376, 1969. 10 p, 5 fig, 1 tab, 7 ref.

Descriptors: *Groundwater movement, *Model studies, *Viscous flow, *Aquifer characteristics, Mathematical studies, Equations, Hydraulic conductivity, Soil profiles, Laminar flow, Diffusion, Boundaries (Surface), Laboratory tests, Velocity.
Identifiers: *Collector wells, *Analogy.

The hydraulics of horizontal collector wells completely penetrating the horizontal impervious base of an isotropic, homogeneous medium is studied by means of viscous flow analogy. The basic idea is to consider a well with an infinite number of collectors in an isotropic medium and an unconfined aquifer. The radial flow towards a horizontal well has been simulated by an apparatus, in which the distance between the plates varies exponentially, thus insuring similarity between the differential equations of the flow in the apparatus and in nature. The apparatus is checked by considering the problem of the gravity well. The free surface and the discharge are determined for the case of a vertical well, which has an infinite number of symmetrically distrubuted collectors and completely penetrates the horizontal impervious base of an unconfined aquifer. (Woodard-USGS)
W71-02266

NON-DARCY FLOW SOLVED BY FINITE ELEMENT ANALYSIS,
Windsor Univ., Ontario. Dept. of Civil Engineering.
J. A. McCorquodale, and H. C. Ng.
French resume. In: Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 4 (Subject D), Science Council of Japan, Kyoto, p 347-355, 1969. 9 p, 2 fig, 4 ref.

Descriptors: *Groundwater movement, *Free surfaces, *Hydraulic conductivity, *Structural analysis, *Methodology, Mathematical studies, Equations, Flow, Seepage, Boundaries (Surfaces).
Identifiers: *Non-Darcy flow.

The finite element method is applied to the solution of non-Darcy flow with a free surface. An effective hydraulic conductivity for each element is defined in terms of the best available solution of the system. The introduction of the effective conductivity linearizes the system of simultaneous equations thus making it possible to obtain a better solution. A theoretical solution is compared with experimental results for flow through a rectangular section. (Woodard-USGS)
W71-02267

THE INTEGRAL DISPLACEMENT OF THE FLUIDS THROUGH NONHOMOGENEOUS POROUS MEDIA,
Academia R.P.R., Bucharest.
D. Dumitrescu, and V. Ionescu.
French resume. In: Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 4 (Subject D), Science Council of Japan, Kyoto, p 329-337, 1969. 9 p, 2 fig, 6 ref.

Descriptors: *Porous media, *Underground storage, *Groundwater movement, *Flow, *Fluid friction, Injection wells, Pressure, Interfaces, Fluid mechanics, Mathematical studies, Equations.
Identifiers: *Non-homogeneous fluids, Fluid displacement.

General equations of motion are used to solve the problem of displacement of a fluid which saturates a non-homogeneous reservoir by another fluid introduced under pressure when there is an interface between the two fluids. (Woodard-USGS)
W71-02268

PHENOMENA OF TURBULENT HORIZONTAL TRANSPORT AND DIFFUSION IN THE TIDAL COASTAL SEAS AND APPLICATION TO THE ENGLISH CHANNEL,
Grenoble Univ. (France). Faculte des Sciences.
For primary bibliographic entry see Field 02L.
W71-02305

FOUR-POINT METHOD OF CHARACTERISTICS,
Technische Hogeschool, Delft (Netherlands).
Michael B. Abbott, and Adrianus Verwey.
ASCE Proceedings, Journal of the Hydraulics Division, Vol 96, No HY12, Paper 7763, p 2549-2564, December 1970. 16 p, 11 fig, 1 tab, 5 ref, 2 append.

Descriptors: *Computer programs, *Analog computers, *Open channel flow, Channel morphology, Numerical analysis, Unsteady flow, Waves (Water), Computer models, Mathematical models.
Identifiers: *Method of characteristics, Computer plotting.

Conservation laws in two independent variables have a four-point symmetry when expressed in normal or characteristic form. For nearly horizontal flows, this symmetry is notated and translated into easily programmed numerical operators. Simple starting and boundary subroutines are described. The output is especially well adapted to digital-analog plotting techniques, with an accuracy superior to any current difference scheme. Bed slopes and resistance terms can be easily introduced, but the method becomes less viable for general streamflows, with changes of channel section. (Knapp-USGS)
W71-02431

PERIODIC PERMANENT ROLL WAVES,
California Univ., Irvine. Dept. of Civil Engineering.
Richard R. Brock.
ASCE Proceedings, Journal of the Hydraulics Division, Vol 96, No HY12, Paper 7764, p 2565-2580, December 1970. 16 p, 9 fig, 1 tab, 8 ref, append.

Descriptors: *Open channel flow, *Waves (Water), *Unsteady flow, *Supercritical flow, Sand waves, Bores, Surges, Model studies, Hydraulic models, Hydraulic jump.
Identifiers: *Open-channel shocks.

Two theories for periodic permanent roll waves are based on the shallow-water wave equations for the gradually varied portion of the wave profile, and the shock conditions for the rapidly varied portion. In the first theory the channel slope, S, is assumed to be sufficiently small that the weight of the shock can be neglected in the shock condition. Comparison of results from this theory for small S with experimental results reveals good agreement for S equals 0.019, but rather large discrepancies for S equals 0.050, 0.084, and 0.12. In the second theory the shock weight is included in the shock condition. Using the measured shock profiles to evaluate the weight of the shock yields theoretical predictions which are in substantial agreement with the experimental results. (Knapp-USGS)
W71-02432

COMPUTATION OF OPEN-CHANNEL SURGES AND SHOCKS,
Thessaloniki Univ., Salonika (Greece). School of Agriculture; and California Univ., Davis. Dept. of Water Science.
For primary bibliographic entry see Field 02E.
W71-02433

HYDRAULIC MODEL STUDIES OF JACKSON LAKE DAM BAFFLE BLOCKS,
Bureau of Reclamation, Denver, Colo. Office of Chief Engineer.
P. H. Burgi.
Available from NTIS as PB-194 001, $3.00 in paper copy, $0.95 in microfiche. Report No REC-OCE-70-12, March 1970. 12 p, 9 fig, 4 tab.

Descriptors: Idaho.
Identifiers: *Sluice gates, Bafles, *Dams, Sluice gates, Hydraulic models, Sluices (Hydraulic engineering), Deterioration, Abrasion, Diverters, Flow distribution, Eddies, Jackson Lake (Wyoming), Jackson Lake dam.

Model studies of the Jackson Lake Dam sluice outlets were conducted to determine the effectiveness of the existing baffle blocks. Tests were run without baffle blocks with baffle blocks and with an end sill. Evaluation of the various configurations was based on scour patterns resulting from each test. Tests without baffle blocks resulted in a prohibitive scour pattern. The end sill yielded a slight improvement in the scour pattern over that of the existing baffle blocks. Sluice operating arrangements were suggested.
W71-02626

8D. Soil Mechanics

INVESTIGATIVE MINE SURVEY OF A SMALL WATERSHED, A FIELD INVESTIGATION TO LOCATE AND DEFINE UNKNOWN OR HIDDEN DRIFT MINE OPENINGS IN THE BROWNS CREEK WATERSHED OF THE WEST FORK RIVER IN WEST VIRGINIA.
Halliburton Co., Duncan, Okla.
For primary bibliographic entry see Field 05G.
W71-02275

GILGAI IN THE QUATERNARY,
Commonwealth Scientific and Industrial Research Organization, Melbourne (Australia).
For primary bibliographic entry see Field 02G.
W71-02505

8F. Concrete

FIRST PROGRESS REPORT ON EVALUATION OF REINFORCED PLASTIC MORTAR PIPE,
Bureau of Reclamation, Denver, Colo. Office of Chief Engineer.
For primary bibliographic entry see Field 08G.
W71-02294

DETERMINING VOLUME AND PRESSURE OF ENTRAPPED AIR IN CONCRETE AND POROUS ROCK MATERIALS SATURATED WITH WATER,
Bureau of Reclamation, Denver, Colo.
M. Z. Simonov.
Available from NTIS as PB-193 659T, $3.00 in paper copy, $0.95 in microfiche. Translated from: Betonizhelezoleton No 5, p 35-36, 1969. Bur of Reclamation, Translation No 824, December 1969. 11 p.
Identifiers: *Concrete, Porosity, *Construction materials, Test methods, *Rock (Geology), Air, Water, Volume, Test equipment, USSR, Translations, Pore pressure, Aggregates (Materials).

Properties of lightweight concretes depend on the conditions for interaction between 2 capillary systems, one in the cement paste and the other in

the porous aggregate. Air is entrapped in concrete capillaries during movement of water in the aggregate capillaries from the periphery to the center or during unilateral contact of porous materials with water due to nonuniform water movement in capillaries of different diameters. A pressure gradient depending on the density increase in the cement paste develops in the contact between the cement paste and the aggregate. This phenomenon explains why lightweight concrete can have greater compressive strength and impermeability than ordinary concrete made under exactly comparable conditions. Pressure of entrapped air can significantly exceed 1 atm. This pressure is determined by computations based on experimental data. Apparatus and methods used to make the necessary measurements are described and then the computations given to convert them to values for the volume and pressure of entrapped air. This method can also be used to determine the actual total volume of interconnected (open) and closed pores and capillaries and the rate of water absorption for negative and atmospheric pressures.
W71-02610

8G. Materials

FIRST PROGRESS REPORT ON EVALUATION OF REINFORCED PLASTIC MORTAR PIPE,
Bureau of Reclamation, Denver, Colo. Office of Chief Engineer.
Carl E. Selander, Fred E. Causey, Amster K. Howard, Jr. and Kenneth B. Hickey.
Available from NTIS as PB-194 492, $3.00 in paper copy, $0.95 in microfiche. Report No REC-OCE-70-34, August 1970. 66 p, 13 tab, 36 fig, 7 ref.

Descriptors: Plastics, Elastomers, Polymers, *Pipes, Mortars, *Plastic pipes, Creep, Durability, Crushing, Fatigue (Mechanics), Laboratory tests, *Performance tests, Scale, Environmental tests, Field tests, Environmental effects, Resins, Strength, Deflection, Properties, Strain, Specifications.
Identifiers: *Pipe tests, Scale effect, Buried pipes, Glass reinforced plastics, *Reinforced plastic mortar pipe, Polyesters, Loading tests.

The report of the study comprises laboratory and field programs, and preparation of specifications and design. The laboratory program consists of (1) Series A - Basin Properties: (2) Series B - Scaling Factors; (3) Series C - Stiffness Correlations; and (4) Load tests on pipe buried in soil. The basic properties are being determined through fatigue, crush, burst, creep, and stiffness studies after exposure in environments of sulfuric acid, pH5; sodium hydroxide, pH9; synthetic soil extract pH7.4 to 8.2 tap water; and distrilled water. Controls and air specimens arae also being tested. Scaling factors are to computed from 12-, 24-, 36-, and 48-in. (30.48-, 60.96-, 91.44, and 121.92-cm) Class 60 irrigation pipe. Conclusions at this point are: (1) RPM pipe appears to follow the stress agin curve for plastics, (2) good stiffness correlation is shown between classes of irrigation pipe, (3) the Iowa Formula for flexible pipe design may require reevaluation for use with RPM pipe, and (4) changes in properties caused by the different environmental exposures appear to be similar, with good chemical resistance apparent.
W71-02294

POLYSULFIDE CANAL CONTRACTION JOINT SEALER, LABORATORY TESTS TO DETERMINE THE EFFECT OF EARLY IMMERSION ON COAL-TAR EXTENDED POLYSULFIDE SEALER PLACED IN FRESH CONCRETE,
Bureau of Reclamation, Denver, Colo. Office of Chief Engineer.
Harry K. Uyeda.
Available from NTIS as PB-194 405, $3.00 in paper copy, $0.95 in microfiche. Report No. REC-OCE-70-29, July 1970. 13 p, 2 tab, 5 fig, 1 ref.

Identifiers: *Polysulfide resins, *Sealers, *Joint sealers, Polysulfide resins, *Concretes, Joint sealers, *Canals, Submerging, Tension tests, Degradation.

Laboratory test show the effect of early immersion on the performance of polysulfide sealer extruded into the fresh concrete of contraction joint grooves. Tensile test results indicate that sealer-concrete bond is a function of the cure time prior to immersion. Although one-day cure time was found to be the minimum acceptable in these tests, several days' curing before immersion improved performance significantly.
W71-02296

GLASS-FIBER REINFORCED POLYESTER LINING,
Bureau of Reclamation, Denver, Colo. Office of Chief Engineer.
Michael E. Hickey.
Available from NTIS as PB-194 527, $3.00 in paper copy, $0.95 in microfiche. Report No REC-OCE-70-36, August 1, 1970. 12 p, 3 tab, 7 fig.

Descriptors:
Identifiers: *Canal linings, Reinforced plastics, *Polyester resins, Canal linings, Casting, Tensile strength, Leakage, Puncture resistance, Field tests, On site construction, *Glass fibers.

Information from an experimental field installation of onsite manufactured (cast-in-place) glass-fiber-reinforced polyester resin canal lining indicated that the lining as installed was not satisfactory. However, the process with further development has definite possibilities for canal lining. Laboratory tests of field test sections of cast-in-place and precast glass-fiber-reinforced polyester lining indicated that the material contained flaw areas of resin not saturating the glass mats, resulting in structural weakness and high water permeation. Test samples of flow-free areas showed that the lining was watertight, tough, strong, and similar to reinforced plastic structural panels used in roofing and skylight construction. Durability of the lining will be determined by periodic examinations of field test sections.
W71-02300

09. MANPOWER, GRANTS AND FACILITIES

9A. Education (Extramural)

INTERNATIONAL HIGHER SUMMER COURSES FOR INSTRUCTORS AND SPECIALISTS IN HYDROLOGY,
Moscow State Univ. (USSR). Dept. of Geography.
V. D. Bykov.
In: The Progress of Hydrology, Vol 3 - Hydrologic Education and Discussions, Proceedings 1st International Seminar for Hydrology Professors, Illinois University, Urbana, July 13-25, 1969, p 1256-1265, published by Univ of Illinois, 1969. 10 p.

Descriptors: *International Hydrological Decade, *Conferences, *Education, *Training, *Schools (Education), Research and development, Universities, Manpower, Geology, Water resources, Hydrogeology, Water resources development, Forecasting, Hydrology, Hydraulics, Engineering, Professional personnel, Scientific personnel, Planning, Research facilities, Laboratories, Model studies, Technology, Computers, Instrumentation.
Identifiers: *Water resources research, *Water resources education, *USSR.

The objective of the International Summer Higher Hydrological Courses in Moscow is to familiarize the participants with the latest achievements of Soviet and foreign hydrology, with trends and ways of further development of a number of hydrological problems. Lectures will be delivered in the Russian language with simultaneous interpretation into English. Practical and laboratory studies will be conducted in Russian with interpretation into English. Curriculum for each academic year provides study of one of the most important problems in hydrology on the basis of the latest scientific achievements as well as consideration of further development of research. The most important hydrological subjects to be considered are the following: calculations of streamflow, hydrological forecasting, modern technique and measuring instruments used in hydrology, control of streamflow, and hydrophysical research into thermal conditions, evaporation, and phenomena and processes related to ice. (Knapp-USGS)
W71-02220

HYDROLOGICAL EDUCATION IN CZECHOSLOVAKIA AND EASTERN EUROPE,
Prague Agricultural Univ. (Czechoslovakia). Dept. of Water Resources.
Jaromir Nemec.
In: The Progress of Hydrology, Vol 3 - Hydrologic Education and Discussions, Proceedings 1st International Seminar for Hydrology Professors, Illinois University, Urbana, July 13-25, 1969, p 1246-1255, published by Univ of Illinois, 1969. 10 p, 2 tab.

Descriptors: *International Hydrological Decade, *Conferences, *Education, *Universities, *Training, Research and development, Manpower, Schools (Education), Geology, Water resources, Water resources development, Forecasting, Hydrology, Hydraulics, Engineering, Professional personnel, Scientific personnel, Planning, Projects, Research facilities, Laboratories, Technology.
Identifiers: *Water resources research, *Water resources education, *Czechoslovakia.

Hydrological education in Czechoslovakia is briefly described. While undergraduate university education in hydrology is available, students have no interest in it. An undergraduate university education is also offered in Czechoslovakia in hydrogeology, jointly with engineering geology. In this last field of specialization, the interest of students, and their prospects of employment, are considerably larger. On the other hand, a postgraduate and highly specialized education is considered as most important for the advancement of Czechoslovak hydrology. Thus, in addition to a regular postgraduate study leading to a doctor's degree, postgraduate courses of a duration of six months are being organized to help the training of highly qualified hydrologists. (Knapp-USGS)
W71-02221

HYDROLOGIC EDUCATION IN SPAIN,
Institute of Hydrology, Madrid (Spain).
R. Heras.
In: The Progress of Hydrology, Vol 3 - Hydrologic Education and Discussions, Proceedings 1st International Seminar for Hydrology Professors, Illinois University, Urbana, July 13-25, 1969, p 1236-1245, published by Univ of Illinois, 1969. 10 p.

Descriptors: *International Hydrological Decade, *Conferences, *Education, *Universities, *Training, Research and development, Manpower, Schools (Education), Geology, Water resources, Water resources development, Forecasting, Hydrology, Hydraulics, Engineering, Professional personnel, Scientific personnel, Planning, Research facilities, Laboratories, Technology.
Identifiers: *Water resources research, *Water resources education, *Spain.

Centers and institutes in Spain where teaching is conducted on miscellaneous aspects of hydrology and on subjects either directly or indirectly related to hydrological problems are briefly described. These subjects are offered in universities or technical schools as a part of their programs. In addition, specialized centers where long or short courses or seminars on various specialized topics in hydrology are given are listed. The school of Hydrology, established by the Instituto de Hidrologia and spon-

sored by the Consejo Superior de Investigaciones Cientificas, is now the only center which organizes specific and continuous courses on hydrology on both surface water and groundwaters. (Knapp-USGS)
W71-02222

CENTRE OF APPLIED HYDROLOGY, HYDRAULICS RESEARCH INSTITUTE, FEDERAL UNIVERSITY OF RIO GRANDE DO SUL,
Universidade Federal do Rio Grande do Sul, Porto Alegre (Brazil).
Jose Leite de Souza.
In: The Progress of Hydrology, Vol 3 - Hydrologic Education and Discussions, Proceedings 1st International Seminar for Hydrology Professors, Illinois University, Urbana, July 13-25, 1969, p 1225-1235, published by Univ of Illinois, 1969. 11 p.

Descriptors: *International Hydrological Decade, *Conferences, *Education, *Universities, *Training, Research and development, Manpower, Schools (Education), Geology, Water resources, Water resources development, Forecasting, Hydrology, Hydraulics, Engineering, Professional personnel, Scientific personnel, Planning, Projects, Research facilities, Laboratories, Model studies, Technology, Computers, Instrumentation.
Identifiers: *Water resources research, *Water resources education, *Brazil.

A Center of Applied Hydrology was set up at the Hydraulics Research Institute of the Federal University at Rio Grande do Sul, Brazil. This Institute is the largest Hydraulics laboratory in Brazil. The facilities include: a Coastal-Research Hall; a River Research Hall; a hall housing the large-scale canal for basic research in river morphology; a sedimentation laboratory; and the central building, which accommodates the administration, offices, library, lecture rooms, the teaching laboratory, two shops, etc. Undergraduate students in Civil Engineering, Mechanical Engineering, Chemical Engineering, Geology and Agricultural Sciences of the Federal University of Rio Grande do Sul do laboratory work in Fluid Mechanics and Hydraulics. The sub-professional training will prepare people for hydrological activities in general and for both field and office activities. The Center of Applied Hydrology will grant a diploma of Master of Science in Applied Hydrology. (Knapp-USGS)
W71-02223

HYDROLOGY IN COLOMBIA,
Universidad de los Andes, Bogota (Columbia). Center of Technical Studies and Investigations in Hydraulics.
Carlos Angulo.
In: The Progress of Hydrology, Vol 3 - Hydrologic Education and Discussions, Proceedings 1st International Seminar for Hydrology Professors, Illinois University, Urbana, July 13-25, 1969, p 1219-1224, published by Univ of Illinois, 1969. 6 p.

Descriptors: *International Hydrological Decade, *Conferences, *Education, *Universities, *Training, Research and development, Manpower, Schools (Education), Geology, Water resources, Water resources development, Forecasting, Hydrology, Hydraulics, Engineering, Professional personnel, Scientific personnel, Planning, Projects, Research facilities, Laboratories, Technology.
Identifiers: *Water resources research, *Water resources education, *Colombia.

Columbia is in northern South America with coasts on both the Atlantic and the Pacific Oceans. Different climatic areas range from a tropical desert in the northeast with an annual precipitation of 4 inches to a tropical rainy zone along the Pacific Coast with an annual precipitation of 450 inches. The country is clearly divided in two zones: the mountainous western zone where 95% of Colombians live, and the completely undeveloped plains of the east. The Colombian Meteorologic and Hydrologic Service is at present studying the location of the existing Hydrometric Stations and will develop a national network. There are about ten universities offering the equivalent of a Bachelor's degree in Engineering in a five year course and two universities offering a Master's Degree in an additional year. Hydrology enters into the Civil Engineering Program as no university has a Department of Hydrology. Hydrology is taken as a compulsory course in most universities and includes a rainfall and streamflow data, evaporation and transpiration, groundwater, the unit hydrograph method, flood frequency analysis and reservoir planning. Urban Hydrology is usually included in a compulsory Sanitary Engineering course. (Knapp-USGS)
W71-02224

EDUCATION IN HYDROLOGY IN JAPAN,
Kyushu Univ., Fukuoka (Japan).
Masatugu Murakami.
In: The Progress of Hydrology, Vol 3 - Hydrologic Education and Discussions, Proceedings 1st International Seminar for Hydrology Professors, Illinois University, Urbana, July 13-25, 1969, p 1209-1218, published by Univ of Illinois, 1969. 10 p.

Descriptors: *International Hydrological Decade, *Conferences, *Education, *Universities, *Training, Research and development, Manpower, Schools (Education), Geology, Water resources, Water resources development, Forecasting, Hydrology, Hydraulics, Engineering, Professional personnel, Scientific personnel, Planning, Research facilities, Laboratories, Technology.
Identifiers: *Water resources research, *Water resources education, *Japan.

Hydrology or related sciences are taught in Japan's Departments of Civil Engineering, Technical Engineering, Agricultural Civil Engineering, Forestry Engineering, Agriculture, Geophysics, Geography, Earth Science, Oceanography, and Biology. In some universities hydrological science is taught as a part in courses of water resources engineering, river engineering or water works engineering in the Department of Civil Engineering. In some Departments of Biology topics on water purification are included in applied freshwater biology. A group training course in groundwater resources development for groundwater technicians from Asian developing countries is held every year in Tokyo. Lectures are on hydrogeology, groundwater hydrology, well hydrology, physical prospecting, photo-geology and water quality. (Knapp-USGS)
W71-02225

HYDROLOGIC EDUCATION IN THE FEDERAL REPUBLIC OF GERMANY,
Technische Hochschule, Hanover (West Germany).
K. Lecher.
In: The Progress of Hydrology, Vol 3 - Hydrologic Education and Discussions, Proceedings 1st International Seminar for Hydrology Professors, Illinois University, Urbana, July 13-25, 1969, p 1191-1194, published by Univ of Illinois, 1969. 4 p.

Descriptors: *International Hydrological Decade, *Conferences, *Education, *Universities, *Training, Research and development, Manpower, Schools (Education), Geology, Water resources, Water resources development, Forecasting, Hydrology, Hydraulics, Engineering, Professional personnel, Scientific personnel, Planning, Laboratories, Technology.
Identifiers: *Water resources research, *Water resources education, *Federal Republic of Germany.

In the universities of the Federal Republic of Germany hydrology does not exist as an independent course of studies. Lectures in hydrology are given within the frame of more general studies, such as in hydraulic constructions in the education of civil engineers, in the sciences of agriculture and forestry, in geography, in geophysics and via hydrogeology in the education of geologists; the hydrologic education is mainly aiming at the practical use, the so-called 'Applied Hydrology.' The consequence is that hydrologists come from all these special fields and that their hydrologic work is strongly characterized by their respective basic studies. (Knapp-USGS)
W71-02226

HYDROLOGIC EDUCATION IN INDIA,
College of Engineering, Madras (India). Dept. of Hydraulic Engineering.
V. C. Kulandaiswamy.
In: The Progress of Hydrology, Vol 3 - Hydrologic Education and Discussions, Proceedings 1st International Seminar for Hydrology Professors, Illinois University, Urbana, July 13-25, 1969, p 1178-1190, published by Univ of Illinois, 1969. 13 p, 2 append.

Descriptors: *International Hydrological Decade, *Conferences, *Education, *Universities, *Training, Research and development, Manpower, Schools (Education), Geology, Water resources, Water resources development, Forecasting, Hydrology, Hydraulics, Engineering, Professional personnel, Scientific personnel, Planning, Research facilities, Laboratories, Technology.
Identifiers: *Water resources research, *Water resources education, *India.

In the Universities, Institutes of Science and Technology and Affiliated Colleges in India, courses in hydrology and topics related to hydrology form part of the curriculum in departments of engineering, geology, agriculture and meteorology. A general discussion surveys the facilities available for hydrologic education in Engineering Colleges, Engineering Universities and Institutes of Science and Technology in India. (Knapp-USGS)
W71-02227

HYDROLOGIC EDUCATION IN AUSTRALIA AND NEW ZEALAND,
Lincoln Coll., Canterbury (New Zealand). Dept. of Agricultural Engineering.
J. R. Burton.
In: The Progress of Hydrology, Vol 3 - Hydrologic Education and Discussions, Proceedings 1st International Seminar for Hydrology Professors, Illinois University, Urbana, July 13-25, 1969, p 1156-1177, published by Univ of Illinois, 1969. 22 p, 7 ref.

Descriptors: *International Hydrological Decade, *Conferences, *Education, *Universities, *Training, Research and development, Manpower, Schools (Education), Geology, Water resources, Water resources development, Forecasting, Hydrology, Hydraulics, Engineering, Professional personnel, Scientific personnel, Research facilities, Laboratories, Technology.
Identifiers: *Water resources research, *Water resources education, *Australia, *New Zealand.

Education in hydrology in Australia and New Zealand is summarized. Hydrology in Australia is largely the function of the civil engineer, and hydrologic teaching is almost entirely restricted to the engineering schools. Applied hydrology is first taught in undergraduate courses, and two schools in particular (the School of Civil Engineering of the University of New South Wales and the School of Agricultural Engineering of the University of Melbourne) provide more extensive teaching in the final undergraduate year, but serious specialization in hydrology and water resources technology is only available in postgraduate courses. The only significant postgraduate programs currently available in Australia are offered by the School of Civil Engineering of the University of New South Wales. The major university research effort in hydrology is centered at the University of New South Wales and its associated Water Research Laboratory. The major center for university research in water resources is the Agricultural Engineering Department of Lincoln College with the associated New Zealand Agricultural Engineering Institute. (Knapp-USGS)

W71-02228

HYDROLOGICAL EDUCATION IN THE UNITED KINGDOM,
Imperial Coll. of Science and Technology, London (England).
M. J. Hall.
In: The Progress of Hydrology, Vol 3 - Hydrologic Education and Discussions, Proceedings 1st International Seminar for Hydrology Professors, Illinois University, Urbana, July 13-25, 1969, p 1136-1155, published by Univ of Illinois, 1969. 20 p, 1 tab, 8 ref.

Descriptors: *International Hydrological Decade, *Conferences, *Education, *Universities, *Training, Research and development, Manpower, Schools (Education), Geology, Water resources, Water resources development, Forecasting, Hydrology, Hydraulics, Engineering, Professional personnel, Scientific personnel, Research facilities, Laboratories, Technology.
Identifiers: *Water resources research, *Water resources education, *United Kingdom.

Although selected aspects of the subject are contained within the scope of most undergraduate courses in both civil engineering and geography, the teaching of hydrology in British universities is concentrated at postgraduate level. No university in the United Kingdom offers an undergraduate course leading to a degree in hydrology, but there are at present seven full-time postgraduate courses of from 9 to 12 months' duration devoted to water resources technology. Five of the seven courses are based in departments of civil engineering. No British university has a department of hydrology. An analysis of the numbers of students attending the above-mentioned courses during the four years 1965-69 has shown that three out of every five were from outside the United Kingdom. (Knapp-USGS)
W71-02229

HYDROLOGIC EDUCATION IN CANADA,
Saskatchewan Univ., Saskatoon. Dept. of Agricultural Engineering; and Saskatchewan Univ., Saskatoon. Div. of Hydrology.
Don M. Gray.
In: The Progress of Hydrology, Vol 3 - Hydrologic Education and Discussions, Proceedings 1st International Seminar for Hydrology Professors, Illinois University, Urbana, July 13-25, 1969, p 1125-1135, published by Univ of Illinois, 1969. 11 p, 2 ref.

Descriptors: *International Hydrological Decade, *Conferences, *Education, *Universities, *Training, Research and development, Manpower, Schools (Education), Geology, Water resources, Water resources development, Forecasting, Hydrology, Hydraulics, Engineering, Professional personnel, Scientific personnel, Research facilities, Laboratories, Technology.
Identifiers: *Water resources research, *Water resources education, *Canada.

While training in specific areas of hydrology is offered at many Canadian Universities, this training is primarily at the graduate level and oriented consistent with the 'classic' Departmental Structure. Under this system, the primary responsibility of the student is to satisfy Departmental requirements for the degree more than to develop competence in his broad field of study. Excellent programs can be found at: University of British Columbia--Oceanography and Forest Hydrology, University of Alberta (Edmonton)--River Engineering, Queen's University and Ecole Polytechnique--Hydraulics, Guelph--Surface Hydrology. Different approaches being used within Canadian Universities to develop interdisciplinary scope in Hydrologic Education are summarized. (Knapp-USGS)
W71-02230

EDUCATION AND RESEARCH IN HYDROLOGY IN FRANCE,
National School of Bridges and Roads, Paris (France).
Jean J. Fried.
In: The Progress of Hydrology, Vol 3 - Hydrologic Education and Discussions, Proceedings 1st International Seminar for Hydrology Professors, Illinois University, Urbana, July 13-25, 1969, p 1109-1124, published by Univ of Illinois, 1969. 16 p, 1 fig.

Descriptors: *International Hydrological Decade, *Conferences, *Education, *Universities, *Training, Research and development, Manpower, Schools (Education), Geology, Water resources, Water resources development, Forecasting, Hydrology, Hydraulics, Engineering, Professional personnel, Scientific personnel, Research facilities, Laboratories, Technology.
Identifiers: *Water resources research, *Water resources education, *France.

Hydrological education in France is briefly summarized. Hydrology is taught the second or the third year in professional schools. It comprises basic hydrology and is developed according to the general trend of each school: for instance the 'Ecole des Ponts et Chaussees' (Bridges and roads) specializes in open-channel flow and urban hydrology. Students who enter the University take basic geology courses and have almost no theoretical courses such as mathematics; they are immediately specialized in geology and related fields, and after three or four years sit for the 'maitrise de geologie' (which is in between B.Sc. and M.Sc.). Most hydrological studies are taken after the 'maitrise', in the 'third cycle' and lead to doctorate theses. The third cycle courses are taught in the four main Universities; Paris, Bordeaux, Montpellier and Toulouse. Education in hydrology is still lagging far behind research; it is very academic without much field work and is somewhat neglected by the great engineering schools which provide the core of French scientists and engineers. These schools are, however, able to educate hydrologists with a sound base in theoretical topics, so that they can define and apply new theories and do rigorous experimental work. (Knapp-USGS)
W71-02231

HYDROLOGIC EDUCATION IN ISRAEL,
Technion - Israel Inst. of Technology, Haifa. Water Resources Research Center.
Jacob Bear.
In: The Progress of Hydrology, Vol 3 - Hydrologic Education and Discussions, Proceedings 1st International Seminar for Hydrology Professors, Illinois University, Urbana, July 13-25, 1969, p 1086-1108, published by Univ of Illinois, 1969. 23 p, 2 ref.

Descriptors: *International Hydrological Decade, *Conferences, *Education, *Universities, *Training, Research and development, Manpower, Schools (Education), Geology, Water resources, Water resources development, Forecasting, Hydrology, Hydraulics, Engineering, Professional personnel, Scientific personnel, Planning, Research facilities, Laboratories, Technology.
Identifiers: *Water resources research, *Water resources education, *Israel.

The syllabi of courses in hydrology and some related subjects at the Technion - Israel Institute of Technology and at the Hebrew University of Jerusalem are listed. Courses are also offered at the Graduate School of the Weizmann Institute of Science especially in the field of geochemistry, isotope geology and the use of isotopes in hydrology. At the Technion, courses are given at the Departments of Civil Engineering and Agriculture Engineering. Both at the Technion and at the Hebrew University, the syllabi are dictated to a large extent by the courtry's present, and especially future needs. These needs also include training of hydrologists who will go and help develop water resources in developing countries, a task which Israel undertakes now in various parts of the world. Field trips which acquaint the student with actual problems are part of the educational programs, as are examples and exercises taken from the practice in Israel. Research in hydrology at the Technion and other Institutions of Higher Education has always been oriented towards solving pressing problems posed by the hydrologist and water resources planner in the field. Close cooperation exists between the staff at these institutions and the practicing engineers. (Knapp-USGS)
W71-02232

AN INTRODUCTION TO TERRESTRIAL HYDROLOGY - A GAP IN TRAINING,
National Academy of Sciences-National Research Council.
L. A. Heindl.
In: The Progress of Hydrology, Vol 3 - Hydrologic Education and Discussions, Proceedings 1st International Seminar for Hydrology Professors, Illinois University, Urbana, July 13-25, 1969, p 1079-1085, published by Univ of Illinois, 1969. 7 p.

Descriptors: *International Hydrological Decade, *Conferences, *Education, *Training, *Universities, Manpower, Research and development, Human resources, Schools (Education), Geology, Water resources, Water resources development, Hydrology, Hydraulics, Engineering, Planning, Research facilities, Laboratories, Technology, Computers.
Identifiers: *Water resources research, *Water resources education.

The need for and the possible content of a course in hydrology that would present the scientific and practical aspects of water studies at an early stage in the university curriculum are discussed. The purposes of the course would be to provide an introduction to hydrology and to its interrelationships with man's concern for his welfare and environment and to interest young students in careers in hydrology. The base for such a course would be the broad concept of hydrology as accepted by the University Council on Water Resources and the International Hydrological Decade, whose definitions of hydrology, in turn, are based on one offered by the Federal Council for Science and Technology. Under this concept hydrology is the science that treats of the waters of the earth, their occurrence, circulation and distribution, their chemical and physical properties, and their reaction with the environment including their relation to living things. This broad concept would be stressed. However, the main thrust of the course should be on the hydrology of land areas. (Knapp-USGS)
W71-02233

TEACHING AIDS AND HYDROLOGY,
Texas Univ., Austin. Dept. of Civil Engineering.
Walter L. Moore.
In: The Progress of Hydrology, Vol 3 - Hydrologic Education and Discussions, Proceedings 1st International Seminar for Hydrology Professors, Illinois University, Urbana, July 13-25, 1969, p 1044-1078, published by Univ of Illinois, 1969. 35 p, 1 fig, 2 append.

Descriptors: *International Hydrological Decade, *Conferences, *Bibliographies, *Education, *Reviews, Libraries, Research and development, Publications, Universities, Schools (Education), Water resources development, Hydrology, Hydraulics, Training, Laboratories, Computers, Research facilities.
Identifiers: *Water resources research, *Water resources education, *Textbooks.

The nature of teaching aids is reviewed in relation to the teaching and learning process; some particular forms of teaching aids are demonstrated, and potential uses of various aids for some subdivisions in hydrology are discussed. A list of current books available in the United States includes general books on hydrology which either include a treatment of the entire subject matter of hydrology or

some major portion of the topic. A much longer list giving information on books in other fields which include treatments of some specific and usually rather limited topics of hydrology and a list of books on physical oceanography is included. The number of motion pictures dealing specifically with hydrological subjects is quite limited. The role of the laboratory in teaching hydrology is yet to be developed. Equipment in conventional hydraulic laboratories are applicable to the teaching of some aspects of hydrology. (Knapp-USGS)
W71-02234

CURRICULUM DEVELOPMENT IN HYDROLOGY,
Arizona Univ., Tucson. Office of Hydrology and Water Resources.
Daniel D. Evans, and John W. Harshbarger.
In: The Progress of Hydrology, Vol 3 - Hydrologic Education and Discussions, Proceedings 1st International Seminar for Hydrology Professors, Illinois University, Urbana, July 13-25, 1969, p 1024-1043, published by Univ of Illinois, 1969. 20 p, 1 fig, 1 tab.

Descriptors: *International Hydrological Decade, *Conferences, *Education, *Training, *Manpower, Research and development, Human resources, Schools (Education), Universities, Water resources development, Hydrology, Hydraulics, Geology, Hydrogeology, Water resources, Engineering, Planning, Research facilities, Laboratories, Technology.
Identifiers: *Water resources research, *Water resources education.

Knowledge required for understanding and solving complex water problems may be considered as a continuum extending from the basic physical and biological sciences, through the applied natural sciences, and a thrust into the behavioral sciences. The breadth of knowledge encompassed is greater than in any other field of study. A complete educational program in hydrology and water resources needs to provide the opportunity for students to specialize in any segment of the continuum as well as the opportunity for others to obtain a general education across the continuum. In order to attempt to fully understand the manifold phases of the hydrologic cycle, the hydrologist must draw upon the knowledge of meteorology, geology, soil science, biology, and engineering, and make constant use of the fundamentals of chemistry, physics, mathematics and statistics. In the solution of everday water problems he needs to collaborate with engineers, economists and other scientists. To analyze problems in water resources involving man and society a scientist must have a basic understanding of hydrology, economics, social sciences, political science, water law, statistics, and operations research. Suggestions are offered for forming university curricula to meet those requirements at undergraduate and graduate levels. (Knapp-USGS)
W71-02235

RELATIONS OF UNIVERSITY HYDROLOGIC PROGRAMS WITH GOVERNMENT AGENCIES,
Kansas Univ., Lawrence. Dept. of Civil Engineering.
For primary bibliographic entry see Field 09D.
W71-02236

COMMENTS ON SOME RECENT TRENDS IN HYDROLOGY RESEARCH,
Office of Water Resources Research, Washington, D.C.
E. D. Eaton.
In: The Progress of Hydrology, Vol 3 - Hydrologic Education and Discussions, Proceedings 1 st International Seminar for Hydrology Professors, Illinois University, Urbana, July 13-25, 1969, p 974-993, published by Univ of Illinois, 1969. 20 p, 14 ref.

Descriptors: *International Hydrological Decade, *Conferences, *Research and development, *Education, *Research factilities, Water resources development, Forecasting, Hydrology, Hydraulics, Groundwater movement, Snow, Ice, Permafrost, Precipitation (Atmospheric), Planning, Projects, Soil water, Lakes, Soil-water-plant relationships, Laboratories, Model studies, Technology, Computers, Instrumentation, Mathematical studies, Systems analysis.
Identifiers: *Water resources research.

Some of the trends in current hydrology research are discussed including some of the research subjects likely to receive increasing attention in the coming years. All seem to relate to developing better understanding of, and better competence to deal with extensive, complex, multivariate systems; the research design and technology generally utilized are well suited to subjects so characterized. Scientific advances are providing powerful predictive tools. Two aspects of system-analysis type research especially require strengthening. One of these is improvement of the design of hydrology research on problems that are strongly influenced by biological and social factors which have the effect of making problem boundary conditions obscure and instable. A second aspect of system-analysis hydrology research that needs strengthening is the processes of appraising risk in situations affecting human life and well-being. (Knapp-USGS)
W71-02237

HYDROLOGIC TRAINING FOR WATER RESOURCES DEVELOPMENT,
Georgia Inst. of Tech., Atlanta. Water Resources Center.
Carl E. Kindsvater, and Willard M. Snyder.
In: The Progress of Hydrology, Vol 3 - Hydrologic Education and Discussions, Proceedings 1st International Seminar for Hydrology Professors, Illinois University, Urbana, July 13-25, 1969, p 962-973, published by Univ of Illinois, 1969. 12 p, 1 tab, 2 ref.

Descriptors: *International Hydrological Decade, *Conferences, *Education, *Manpower, *Professional personnel, Governments, Universities, Human resources, Hydrology, Scientific personnel, Planning, Projects, Research facilities, Laboratories.
Identifiers: *Water resources research, *Water resources education.

New university programs in hydrology are predominantly at the graduate level and they tend to attract an inordinately large number of mature students with a variety of job experiences. The result is an exceptionally responsive feed-back relationship between job requirements and educational programs. Training the hydrologist for water resources development implies training for technological, not scientific endeavor. The hydrologist is, however, a full-fledged professional, springing generally from a bachelor's-degree education in a field such as civil engineering, geology, or soil physics. Breadth in the hydrologist's training implies sufficient knowledge of the natural and social sciences to communicate effectively in an interdisciplinary environment. The hydrologist should have a solid foundation in modern operational mathematics, and he should have basic training in operations research, systems analysis, statistics and probability, and computer technology. The hydrologist must also be educated in considerable depth in all of the allied disciplines, including the auxiliary hybrids known as hydrometeorology and hydrogeology. (Knapp-USGS)
W71-02238

MANPOWER NEEDS IN HYDROLOGY,
Wisconsin Univ., Madison. Dept. of Civil Engineering.
Arno T. Lenz.
In: The Progress of Hydrology, Vol 3 - Hydrologic Education and Discussions, Proceedings 1st International Seminar for Hydrology Professors, Illinois University, Urbana, July 13-25, 1969, p 954-961, published by Univ of Illinois, 1969. 8 p, 1 tab.

Descriptors: *International Hydrological Decade, *Conferences, *Education, *Manpower, Universities, Governments, Engineering, Employment, Human resources, Hydrology, Professional personnel, Scientific personnel, Planning, Projects, Research facilities, Laboratories.
Identifiers: *Water resources research, *Water resources education.

The present manpower situation is reviewed with regard to needs in hydrologic education. Competence in hydrology requires at least minimal competence in one or more of the other earth sciences and the application of hydrology frequency involves the application of civil, hydraulic and sanitary engineering because water is such an important part of man's environment. Hydrologists have entered into broader fields, or scientists from broader fields now consider themselves hydrologists. Greater depth of concentration is also of increasing importance. The professional manpower needs of government agencies, universities, consulting firms, and other employers of hydrologists are briefly summarized. (Knapp-USGS)
W71-02239

INTERNATIONAL COOPERATION IN HYDROLOGIC EDUCATION,
Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
Maurice L. Albertson.
In: The Progress of Hydrology, Vol 3 - Hydrologic Education and Discussions, Proceedings 1st International Seminar for Hydrology Professors, Illinois University, Urbana, July 13-25, 1969, p 938-953, published by Univ of Illinois, 1969. 16 p, 6 ref.

Descriptors: *International Hydrological Decade, *Conferences, *Human resources, *Education, *Manpower, Training, Water resources development, Forecasting, Hydrology, Hydraulics, Planning, Projects, Research facilities, Exploration, Economics, Laboratories, Technology.
Identifiers: *Water resources research, *Water resources education.

International cooperation in education in general, and such cooperation in water resources or hydrologic education in particular are discussed, treating the concept of human resources development as more important than physical resources to developing countries. The sub-category of manpower resources must, of course, consider both quantity and quality of the manpower resource. The information resource is the body of knowledge available for all mankind, and the cultural resources include the over-all cultural background, as well as the institutional structure which is necessary for the manpower resource to be effective. Basically, the necessary human resources can be provided either from indigenous personnel or from human resources outside the country in question. Both sources of human resources must be drawn upon very heavily. (Knapp-USGS)
W71-02240

INTERNATIONAL HYDROLOGIC EDUCATION THROUGH FELLOWSHIPS AND ASSISTANTSHIPS,
Nevada Univ., Reno. Desert Research Inst.
William S. Butcher.
In: The Progress of Hydrology, Vol 3 - Hydrologic Education and Discussions, Proceedings 1st International Seminar for Hydrology Professors, Illinois University, Urbana, July 13-25, 1969, p 1011-1023, published by Univ of Illinois, 1969. 13 p, 4 ref.

Descriptors: *International Hydrological Decade, *Conferences, *Education, *Grants, Research and development, Schools (Education), Universities, Training, Governments, Water resources development, Hydrology, Hydraulics, Planning, Projects, Research facilities, Laboratories, Technology.

Identifiers: *Water resources research, *Water resources education.

The education and training program in the International Hydrological Decade occurs at national and international levels. At the international level, it has been possible to set up regional training centers, as well as training courses for hydrological technicians in some of the less developed countries, by working in cooperation with various other international organizations. Many countries, working through their own National Committees, have been able to achieve substantial progress in the education and training area. From the outset, education and training has been an important part of the concern of the US/IHD National Committee. Sources of support for foreign and U. S. students in hydrology are summarized. (Knapp-USGS)
W71-02241

HYDROLOGY IN TAIWAN,
National Taiwan Univ., Taipei. Dept. of Civil Engineering.
Yen-Chi Lu.
In: The Progress of Hydrology, Vol 3 - Hydrologic Education and Discussions, Proceedings 1st International Seminar for Hydrology Professors, Illinois University, Urbana, July 13-25, 1969, p 1195-1208, published by Univ of Illinois, 1969. 14 p, 1 fig, 3 tab.

Descriptors: *International Hydrological Decade, *Hydrogeology, *Conferences, *Water resources development, Climates, Topography, Research and development, Forecasting, Hydrology, Hydraulics, Precipitation (Atmospheric), Soil conservation, Land management, Planning, Projects, Research facilities, Exploration, Economics, Rainfall-runoff relationships, Education, Training, Laboratories, Technology.
Identifiers: *Water resources research, *Taiwan.

The physiography and hydrology of Taiwan are briefly summarized and the education in hydrology available there is outlined. The whole island is very mountainous, and only its western coastal plain is comparatively flat. Mountain slopes are steep. Rivers are short and rapid. The top soil containing gravel is shallow and easily eroded. In addition to natural factors which contribute to soil erosion, population pressure and the lack of knowledge of soil conservation among farmers make the situation even more serious. Research in recent years by hydrologists, meteorologists and hydraulic engineers in various organizations such as Taiwan Provincial Weather Bureau (TPWB); Water Resources Planning Commission (WRPC); Taiwan Power Company (TPC); Taiwan Provincial Water Conservancy Bureau (TPWCB); and Shihmen Reservoir Promotion Committee (SRPC) are described. One semester course of hydrology in the junior year is required of all civil engineering students. Several courses related to hydrology, such as water resources engineering, water supply, and sewerage engineering are available in the senior year. A two year graduate program in civil engineering was established in 1960 at the National Taiwan University, leading to a M.S. degree. There have been few students interested in specializing in hydrology. (Knapp-USGS)
W71-02242

INVENTORY OF RESEARCH PROJECTS IN THE PACIFIC NORTHWEST: SUPPLEMENT NUMBER ONE.
Federal Water Quality Administration, Portland, Oreg.

January 1970. 50 p, 7 tab, 1 fig.

Descriptors: *Research and development, *Abstracts, Documentation, Education, Training, Water pollution control, Water quality.
Identifiers: Pacific Northwest.

The status of all FWQA funded research and development projects in the Pacific Northwest as of December 31, 1969 is tabulated. Projects which were terminated in 1969 or which began prior to January 1, 1969 are listed by title, principal investigator and organization only. Projects initiated in 1969 are listed with full abstract information. Data on FWQA sponsored fellowships and traineeships for Fiscal Year 1969 is given. An introductory chapter describes the research and development program administered by FWQA. (Barich-FWQA)
W71-02307

FISCAL 1970 ANNUAL REPORT.
Pennsylvania State Univ., University Park. Inst. for Research on Land and Water Resources.
For primary bibliographic entry see Field 09D.
W71-02311

ANNUAL REPORT OF ACTIVITIES FOR FISCAL YEAR 1970,
Illinois Univ., Urbana. Water Resources Center.
For primary bibliographic entry see Field 09D.
W71-02319

9C. Research Facilities

TECHNICAL, INTELLIGENCE, AND PROJECT INFORMATION SYSTEM FOR THE ENVIRONMENTAL HEALTH SERVICE, VOLUME I. MANAGEMENT ASSISTANCE AND PLANNING,
Environmental Health Service, Rockville, Md.
For primary bibliographic entry see Field 10.
W71-02288

TECHNICAL INTELLIGENCE, AND PROJECT INFORMATION SYSTEM FOR THE ENVIRONMENTAL HEALTH SERVICE. VOLUME II. EHS INFORMATION NETWORK ANALYSIS,
Environmental Health Service, Rockville, Md.
For primary bibliographic entry see Field 10.
W71-02289

TECHNICAL, INTELLIGENCE, AND PROJECT INFORMATION SYSTEM FOR THE ENVIRONMENTAL HEALTH SERVICE. VOLUME III. LEAD MODEL CASE STUDY,
Environmental Health Service, Rockville, Md.
For primary bibliographic entry see Field 10.
W71-02290

TECHNICAL, INTELLIGENCE, AND PROJECT INFORMATION SYSTEM FOR THE ENVIRONMENTAL HEALTH SERVICE. VOLUME IV. PESTICIDES MODEL CASE STUDY,
Environmental Health Service, Rockville, Md.
For primary bibliographic entry see Field 10.
W71-02291

9D. Grants, Contracts, and Research Act Allotments

RELATIONS OF UNIVERSITY HYDROLOGIC PROGRAMS WITH GOVERNMENT AGENCIES,
Kansas Univ., Lawrence. Dept. of Civil Engineering.
Robert L. Smith.
In: The Progress of Hydrology, Vol 3 - Hydrologic Education and Discussions, Proceedings 1st International Seminar for Hydrology Professors, Illinois University, Urbana, July 13-25, 1969, p 994-1010, published by Univ of Illinois, 1969. 17 p, 3 ref.

Descriptors: *International Hydrological Decade, *Conferences, *Manpower, *Education, Training, Research and development, Governments, Universities, Human resources, Scientific personnel, Professional personnel, Water resources development, Forecasting, Hydrology, Hydraulics, Planning, Projects, Research facilities, Laboratories, Technology.
Identifiers: *Water resources research, *Water resources education.

Manpower considerations are most significant in determining the nature and extent of university educational programs. In all nations, whether developed or developing, and in certain disciplines, the educational effort often requires that emphasis be placed on mass production of 'how-to-do-it' graduates. As initial needs are met, the educational programs can devote appreciably more emphasis to scientific advancement via research and graduate instruction. University-government relations must be responsive to these changing conditions. There can be no fixed formula for appraising the adequacy of university relations with government agencies. Adequate communications and forthright appraisal of relative strengths and weaknesses are fundamental to the maintenance of satisfactory relations. Some general guidelines are suggested, but their application to specific cases must recognize the evolutionary processes that are ever present. (Knapp-USGS)
W71-02236

TECHNICAL, INTELLIGENCE, AND PROJECT INFORMATION SYSTEM FOR THE ENVIRONMENTAL HEALTH SERVICE, VOLUME I. MANAGEMENT ASSISTANCE AND PLANNING,
Environmental Health Service, Rockville, Md.
For primary bibliographic entry see Field 10.
W71-02288

TECHNICAL INTELLIGENCE, AND PROJECT INFORMATION SYSTEM FOR THE ENVIRONMENTAL HEALTH SERVICE. VOLUME II. EHS INFORMATION NETWORK ANALYSIS.
Environmental Health Service, Rockville, Md.
For primary bibliographic entry see Field 10.
W71-02289

TECHNICAL, INTELLIGENCE, AND PROJECT INFORMATION SYSTEM FOR THE ENVIRONMENTAL HEALTH SERVICE. VOLUME III. LEAD MODEL CASE STUDY,
Environmental Health Service, Rockville, Md.
For primary bibliographic entry see Field 10.
W71-02290

TECHNICAL, INTELLIGENCE, AND PROJECT INFORMATION SYSTEM FOR THE ENVIRONMENTAL HEALTH SERVICE. VOLUME IV. PESTICIDES MODEL CASE STUDY,
Environmental Health Service, Rockville, Md.
For primary bibliographic entry see Field 10.
W71-02291

FISCAL 1970 ANNUAL REPORT.
Pennsylvania State Univ., University Park. Inst. for Research on Land and Water Resources.

Institute for Research on Land and Water Resources, Information Report No 64, University Park, Pa., July 1970. 247 p, 2 append.

Descriptors: *Training, *Universities, *Education, Allotments, Grants, Acid streams, *Pennsylvania, Eutrophication, Water pollution, Waste water treatment, Carbonates, Hydrogeology, Watershed management, Phosphates, Water pollution sources, E. coli, Sewage effluents, Aquatic microbiology, Demand, Supply, Recreation, Social impact, Public lands, Zoning, Planning, Land use.
Identifiers: Highway economic impact, New land uses, Acquisition practices, Tourism, Soil productivity, Roadside ecology, Economic data systems.

This publication serves the dual purposes of being an annual report of the Institute and of satisfying the reporting requirements to the Office of the Water Resources Research under P.L. 88-379. Separate sections within the publication are devoted to the activities and research projects of

the Land Resources Center, Water Resources Center, and Regional Analysis Center. Indicating the interdisciplinary nature of the Institute are the 158 Institute personnel who represented 9 colleges and 27 academic departments at Penn State. Numerous broad lines of research are reported with concentrations in such areas as: pollution control; pollutant identification; renovation of waste water; management of watersheds to increase water yields; control of plant growth in streams; hydrologic and hydrogeologic studies; development of water supply and waste water systems to meet community and regional needs; highway economic impact; land use planning and zoning procedures; identification of new land uses for rural areas; development of equitable public land acquisition practices; social impact of water reservoir development; potentials of tourism and recreation; the development of computer programs for analyzing the growth potentials of economic regions; biological and engineering studies of land and water resources; economic efficiency studies; acid water neutralization; land suitability for septic tank disposal systems; soil productivity; roadside ecology; economic data systems; and costs of pollution in terms of recreation. Contains 2 appendices. (Sink-Penn State)
W71-02311

ANNUAL REPORT OF ACTIVITIES FOR FISCAL YEAR 1970,
Illinois Univ., Urbana. Water Resources Center.
Ben B. Ewing.
Annual Report No 6, July 11, 1970. 199 p.

Descriptors: Water resources, *Illinois, Training, *Universities, *Education, Allotments, Grants.
Identifiers: Water resources research, *Annual report.

The University of Illinois Water Resources Center was established in 1963 to 'encourage and coordinate university-wide planning and implementation of interdisciplinary programs for research and graduate education in water resources'. Since designation as the Title 1 OWRR 'Institute' for Illinois, the Center's activities have become statewide. This report describes research accomplishments and other activities of the Center during fiscal year 1970 and also describes plans for the remainder of the calendar year. The Center's programs are sponsored both under Title 1 of P.L. 88-379 and from other sources such as state funds. The Center's fiscal year 1970 research program included a total of 32 projects of which 13 were included in the annual allotment from OWRR, 14 were partially sponsored by matching grants from OWRR and 5 were completely sponsored with state funds. A progress report for each project is presented. (Ewing-Illinois)
W71-02319

10. SCIENTIFIC AND TECHNICAL INFORMATION

TEACHING AIDS AND HYDROLOGY,
Texas Univ., Austin. Dept. of Civil Engineering.
For primary bibliographic entry see Field 09A.
W71-02234

TECHNICAL, INTELLIGENCE, AND PROJECT INFORMATION SYSTEM FOR THE ENVIRONMENTAL HEALTH SERVICE, VOLUME I. MANAGEMENT ASSISTANCE AND PLANNING,
Environmental Health Service, Rockville, Md.
D. L. Morrison, D. B. Menzel, K. L. Nielsen, A. A. Levin, and C. W. Hamilton.
Available from NTIS as PB-194 410, $3.00 in paper copy, $0.95 in microfiche. Final Report to Consumer Protection and Environmental Health Service, June 29, 1970. 83 p, 10 tab, 5 fig, 5 ref. HEW Contract CPS-69-005.
Identifiers: *Research management, Public health, *Project planning, *Public health, *Environments, Management, Management analysis, Management methods, Management planning, Pollution, Mathematical models, Forecasting, Information systems, Hazards, Hazardous materials, Monitoring, *Environmental health.

The concepts embodied in the development and implementation of a comprehensive R and D and program planning capability for EHS were examined. Environmental stressors were selected as the basis for planning rather than categorical approaches. For the mix of complex problems encountered by EHS, s system to establish priorities is required. The integrated planning system which was recommended utilizes mathematical models to assess the impacts of technology upon man and his environment and the assignment of priorities based upon quality of life indices. Specific elements of the management-assistance system which was defined include an overview environmental health planning function to provide coordinated and comprehensive planning in the man-centered ecosystem context; an impact assessment capability based upon a hierarchy of mathematical models; a threat identification function to identify and evaluate potential threats to man and the environment through intensification or extension of current use patterns of products and services or through introduction of new stressors; and an environmental health information network to provide a well-organized information base. A hierarchical approach to the development of mathematical models for prediction of the impacts of stressors upon man and the environment was described and specific examples are presented for lead in the environment. (See also W71-02289)
W71-02288

TECHNICAL INTELLIGENCE, AND PROJECT INFORMATION SYSTEM FOR THE ENVIRONMENTAL HEALTH SERVICE. VOLUME II. EHS INFORMATION NETWORK ANALYSIS,
Environmental Health Service, Rockville, Md.
Ralph L. Darby, Robert S. Kohn, Thomas E. Carroll, W. David Penniman, and David L. Morrison.
Available from NTIS as PB-194 411, $3.00 in paper copy, $0.95 in microfiche. Final Report to Consumer Protection and Environmental Health Service, June 29, 1970. 128 p, 23 tab, 15 fig, 38 ref. HEW Contract CPS-69-005.
Identifiers: *Information systems, *Environmental surveys, *Research management, Public health, *Project planning, *Public health, *Environments, Environmental engineering, Information retrieval, Surveillance, Monitors, Libraries, Resources, Thesauri, Data storage, Documentation, Computer programs, *Environmental health.

The study for the Environmental Health Service is an investigation of the problems being faced in protecting man's environment from threats created by man. This study included the following major efforts: (1) research and development planning in the perspective of man in his total environment, (2) information network analysis, and (3) model case studies. This volume of the report concerns itself with Information Network Analysis. An investigation was made of the existing EHS information resources including the monitoring and surveillance activities. A survey was conducted of the documentation systems and libraries in order to determine their operational characteristics as related to an information network. (See also W71-02290)
W71-02289

TECHNICAL, INTELLIGENCE, AND PROJECT INFORMATION SYSTEM FOR THE ENVIRONMENTAL HEALTH SERVICE. VOLUME III. LEAD MODEL CASE STUDY,
Environmental Health Service, Rockville, Md.
Garson A. Lutz, Arthur A. Levin, Sanford G. Bloom, Kaj L. Nielsen, and Jack L. Cross.
Available from NTIS as PB-194 412, $3.00 in paper copy, $0.95 in microfiche. Final Report to Consumer Protection and Environmental Health Service, June 29, 1970. 129 p, 26 tab, 17 fig, 500 ref. HEW Contract CPS-69-005.
Identifiers: *Air pollution, Lead (Metal), *Lead (Metal), *Pollution, *Public health, *Project planning, Public health, Toxicity, Ecology, Mathematical models, Hazards, Diseases, Economic analysis, Fuels, Sources, Air pollution, Environments, Research management, Children, Hazardous materials, *Environmental health.

The lead model case study was undertaken to serve as a working example and to evaluate the technical, intelligence, and project information system under consideration for EHS. Occurrence and use patterns for lead within the U. S. were examined. The major categories of uses in decreasing order were production of storage batteries and accessories, gasoline antinock additives, pigments, ammunition, solder, cable covering, and caulking lead. Leaded fuels are the major source of environmental lead. Pediatric plumbism, the most significant acute health problem, arises from lead used as a pigment. The economic aspect of this problem area were investigated. While lead is very slowly absorbed from environmental sources, its gradual accumulation in the body is the basis for progressive toxicity. Additional research is required to determine the chronic effects of lead in the environment on health, and better diagnostic and therapeutic techniques are needed in support of this research. A mathematical model was developed to represent the environmental transport of the stressor lead from several sources with the subsequent intake of lead by man. This model can be used to assess the impact of contemplated actions on lead body burdens, to define R and D requirements, and to identify the needs and locations for monitoring and surveillance. A categorized bibliography for lead is included. (See also W71-02291)
W71-02290

TECHNICAL, INTELLIGENCE, AND PROJECT INFORMATION SYSTEM FOR THE ENVIRONMENTAL HEALTH SERVICE. VOLUME IV. PESTICIDES MODEL CASE STUDY,
Environmental Health Service, Rockville, Md.
J. K. Yoss, J. W. Blaylock, M. J. Schneider, L. C. Schwendiman, and C. J. Touhill, Jr.
Available from NTIS as PB-194 413, $3.00 in paper copy, $0.95 in microfiche. Final Report to Consumer Protection and Environmental Health Service, June 29, 1970. 53 p, 16 tab, 9 fig, 91 ref. HEW Contract CPS-69-005.
Identifiers: *Air pollution, DDT, *Water pollution, *Pesticides, Pollution, *Public health, *DDT, *Project planning, Public health, Ecology, Hazards, Hazardous materials, Models, Chlorohydrocarbons, Sources, Air pollution, Water pollution, Environments, Toxicity, Environmental health.

DDT was selected as the compound for this study due to paucity of data regarding environmental effects of other classes of pesticides. Human exposure to pesticides was examined from two major pathways; the direct pathway which deals with direct uptake from primary sources of pesticide release, and the indirect pathway which involves human exposure by translocation through air, water, or food. Reductions in accidential poisonings could be made by limiting the total toxicant contents of home packages of pesticides, and means to reduce deaths from aerial applications warrant further study of this method of application. The control of human burden of pesticides by control of food residues is only partially effective since evidence on pesticide distribution in the environment suggests that about half of the intake is from inhalation of insecticide aerosols or dust laden with insecticides. There is presently no evidence that pesticide exposure directly shortens human life. Fish and birds are more sensitive to pesticides in the environment. Fish lack the basic microsomal oxidase enzyme systems which detoxify pesticides and birds appear to be very sensitive to the sterodal hormone mimicking effects of the chlorinated hydrocarbons. (See also W71-02292)
W71-02291

TECHNICAL, INTELLIGENCE, AND PROJECT INFORMATION SYSTEM FOR THE ENVIRONMENTAL HEALTH SERVICE. VOLUME V. DIRECTORY OF EHS INFORMATION FACILITIES WITH SELECTED SUPPLEMENTARY RESOURCES,
Environmental Health Service, Rockville, Md.
Ralph L. Darby, Robert S. Kohn, Thomas E. Carroll, W. David Penniman, and David L. Morrison.
Available from NTIS as PB-194 414, $3.00 in paper copy, $0.95 in microfiche. Final Report to Consumer Protection and Environmental Health Service, June 29, 1970. 62 p. HEW Contract CPS-69-005.
Identifiers: *Research management, Public health, *Project planning, Public health, *Public health, *Environments, *Information systems, Environmental surveys, Management methods, Management planning, Management environmental engineering, Information retrieval, Libraries, Resources, Surveillance, Monitors, *Environmental health.

This study is a multifaceted and intensive investigation of the problems facing the EHS in protecting man's environment from the threats created by man. This study included the following major efforts: (1) research and development planning in the perspective of man in his total environment, (2) information network analysis, and (3) model case studies. This directory represents an inventory of information and data resources useful to the personnel of the Environmental Health Service. It is divided into three principal categories: (1) EHS-sponsored resources, (2) non-EHS resources, and (3) monitoring and surveillance activities of both the National Air Pollution Control Administration. A subject-index, an index of information facilities, and an index of the parent or sponsoring organization are provided. (See also W71-02288)
W71-02292

INVENTORY OF RESEARCH PROJECTS IN THE PACIFIC NORTHWEST: SUPPLEMENT NUMBER ONE.
Federal Water Quality Administration, Portland, Oreg.
For primary bibliographic entry see Field 09A.
W71-02307

DIRECTORY OF FEDERALLY SUPPORTED INFORMATION ANALYSIS CENTERS.
Federal Council for Science and Technology, Washington, D.C. Committee on Scientific and Technical Information.

Available from NTIS as PB-189 300, $3.00 in paper copy, $0.95 in microfiche. COSATI-70-1, January 1970. 71 p.

Descriptors: *Documentation, Data storage and retrieval, Data collections, Information retrieval.
Identifiers: *Information analysis centers, Data, *Directories, Information, Information services.

This directory of 119 Federally supported information analysis centers is descriptive, containing information on mission, scope, and services provided by the listed centers. Included are an index of subject areas covered by the centers, an index of center directors, a list of organizations, and a list of locations. The centers are numbered serially to facilitate indexing.
W71-02310

EFFECTS OF LAND MANAGEMENT ON QUANTITY AND QUALITY OF AVAILABLE WATER,
New South Wales Univ., Kensington (Australia). Water Research Lab.
For primary bibliographic entry see Field 04C.
W71-02452

BIBLIOGRAPHY OF MONTANA WATER RESOURCES AND RELATED PUBLICATIONS.
Montana Water Resources Board, Helena.

Montana Water Resources Board Inventory Series Report No 10, 1969. 91 p, 2 index, append.

Descriptors: *Bibliographies, *Water resources, *Montana, Documentation, Surface waters, Groundwater, Water supply, Water quality, Consumptive use, Water measurement.
Identifiers: Literature search.

This bibliography lists all of the known printed information, both published and unpublished, available to the Montana Water Resources Board as of December, 1968. It has been compiled as a part of the Inventory phase of the State Comprehensive Water and Related Land Resources Plan (State Water Plan). The bibliography is arranged in two sections and the material is coded so that it may be useful to researchers seeking references in any of a number of ways. The coding system is based upon the Descriptor Groups presented in the Water Resources Thesaurus published by the Office of Water Resources Research, U.S. Department of the Interior in November, 1966. Section 1, the author index, lists the complete reference alphabetically according to author. Also included are the complete code numbers for each reference. In Section 2, the code numbers are listed in sequence opposite the names of authors. With this list the researcher may locate all materials pertaining to a particular subject as listed in the Descriptor Groups in Appendix I. The list in section 2 also allows the researcher to easily segregate material on a specific river basin or county by examining the code in the second column. (Woodard-USGS)
W71-02469

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ABSTRACT SOURCES

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C. Other		
Environmental Protection Agency Water Quality Office	W71-02275--02278 02474--02475 02477	7
Analytical Methodology (Battelle Memorial Institute)	W71-02673--02674 02676--02683	10
Engineering Aspects of Urban Water Resources (H G Poertner)	W71-02283--02287	5
Bureau of Public Roads	W71-02522--02523 02525	3
Forest Service	W71-02750	1

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CENTERS OF COMPETENCE AND THEIR SUBJECT COVERAGE

- Ground and surface water hydrology at the Water Resources Division of the U.S. Geological Survey, U.S. Department of the Interior.
- Metropolitan water resources management at the Center for Urban Studies of the University of Chicago.
- Eastern United States water law at the College of Law of the University of Florida.
- Policy models of water resources systems at the Department of Water Resources Engineering of Cornell University.
- Water resources economics at the Water Resources Research Institute of Rutgers University.
- Design and construction of hydraulic structures; weather modification; and evaporation control at the Bureau of Reclamation, Denver, Colorado.
- Eutrophication at the Water Resources Center of the University of Wisconsin, jointly sponsored by the EPA, Soap and Detergent Association, and the Agricultural Research Service.
- Water resources of arid lands at the Office of Arid Lands Studies of the University of Arizona.

Supported by the Environmental Protection Agency in cooperation with WRSIC.

- Thermal pollution at the Department of Sanitary and Water Resources Engineering of Vanderbilt University.
- Textile wastes pollution at the School of Textiles of North Carolina State University.
- Water quality requirements for freshwater and marine organisms at the College of Fisheries of the University of Washington.
- Wastewater treatment and management at the Center for Research in Water Resources of the University of Texas.
- Agricultural Livestock Wastes at the Department of Agricultural Engineering of Iowa State University.

Subject Fields

1 NATURE OF WATER

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